THE DESIGN OF CONTEMPORARY SCHOOLS IN THE UNITED STATES OF AMERICA

by

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TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

More than one-fourth of the population in the United States spend their working days in schools as pupils or teachers. Schools are big business today. They will continue to grow dramatically in the years ahead. The planning, designing, and building of the school buildings are all of vital importance to the students, the educators, the community and the entire country. The approach to the problem will vary in each region according to its traditions, its resources, and its own particular way of organizing and operating its school. But the basic approach to the planning and designing will be the same.

The primary intention of this design project is to determine the proper procedure in designing schools for a given community as a model study of its kind. In this design project all three schools for Manhattan, Kansas--The Child Development Laboratory at Kansas State University; the Elementary School; and the Secondary School--were designed with a definite educational philosophy in mind, namely: the concept of team teaching combined with those of intensified individual instruction, increased use of audio-visual aids, decentralized resource facilities, and efficient environmental controls.

CHAPTER II

THE PUBLIC EDUCATION IN KANSAS

Public education has always been of vital importance to Kansas. It had its origin in territorial days and was given recognition in the state constitution. In early statehood the major concern was elementary education. School districts, to provide such education, were created largely on the basis of immediate convenience, and with little statewide planning. As the need for high school education was recognized, and the idea of providing it at public expense became accepted, a high school was built in practically every village. Just as the school districts for elementary education were created to fit the conditions existing in early statehood, so the high school development was geared to the conditions which prevailed more than a half-century ago. From these origins, 50 to 100 years ago, has developed the state wide system of public education.

There are approximately a half million elementary and secondary school pupils being educated under various organizational patterns, today, in Kansas.[1] More than ninety per cent of them are in public school system.[2] Approximately sixty per cent of the public school pupils are educated in districts

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[1]Comprehensive Educational Survey of Kansas, Kansas Legislative Council.

[2]Ibid.

which operate both elementary and secondary schools, thirty per cent in districts having elementary schools only, and ten per cent in districts having secondary schools only.

More than one-tenth of the twenty-eight hundred school districts in Kansas are operating no schools. The most common school organization in the state is the eight-year elementary school and four-year secondary schools, usually there is a separate district operating each. There are one hundred and five public schools ranging from under one thousand to over ten thousand in enrollment, evenly distributed among the counties of the state (Table I).

TABLE I

THE DISTRIBUTION OF COUNTIES BY SIZE OF PUBLIC SCHOOL ENROLLMENTS, SEPTEMBER, 1958[a]

Public School enrollments	Number of counties by sections			Entire State
	Western	Central	Eastern	
Under 1,000	13	1	2	16
1,000 - 1,999	15	13	8	36
2,000 - 2,999	--	10	9	19
3,000 - 3,999	2	2	4	8
4,000 - 4,999	1	2	4	7
5,000 - 9,999	--	5	8	13
10,000 and over	--	2	4	6
Total	31	35	39	105

[a]Comprehensive Educational Survey of Kansas, Kansas Legislative Council.

FIGURE 1

KANSAS SCHOOL CENSUS 1920 - 1962
AGE 5 - 21

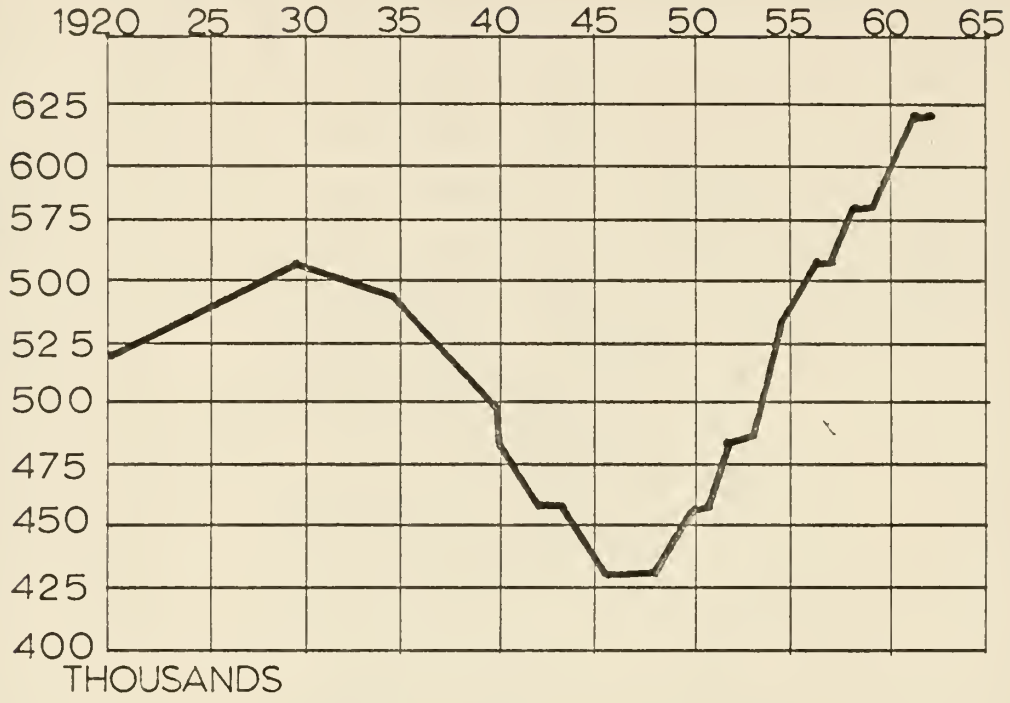


FIGURE 2

ENROLLMENT IN KANSAS ELEMENTARY SCHOOLS
GRADE 1-8 , 1920 - 62

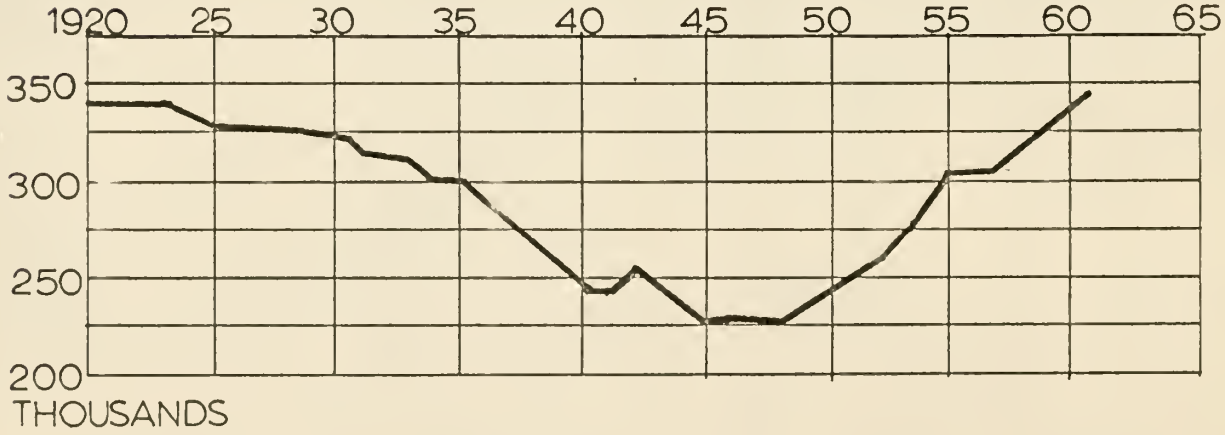


FIGURE 3
ENROLLMENT IN KANSAS HIGH SCHOOLS
GRADE 9-12, 1920-62

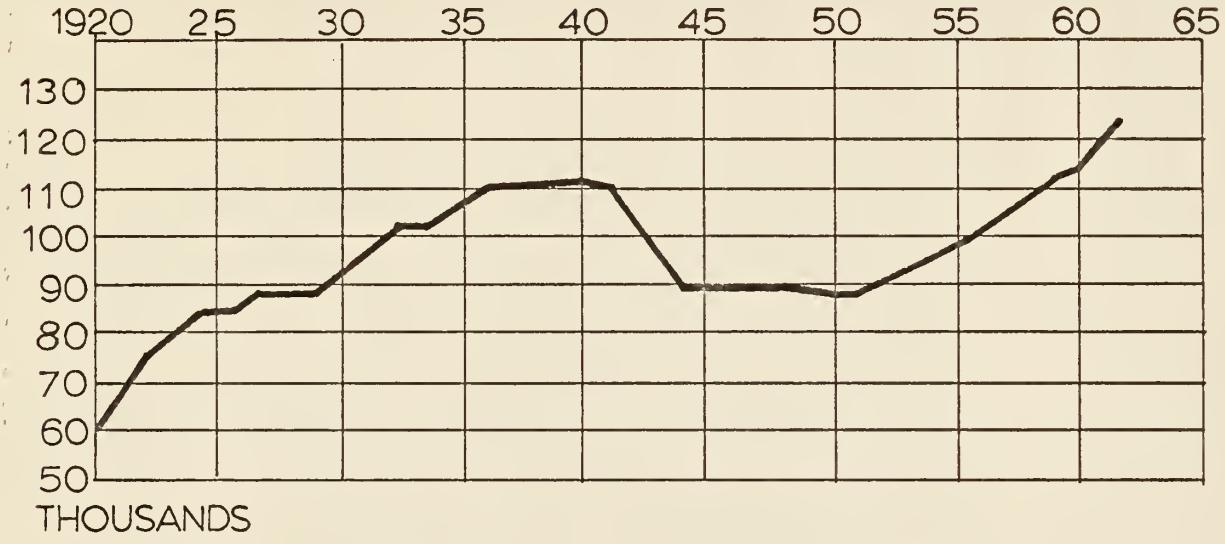
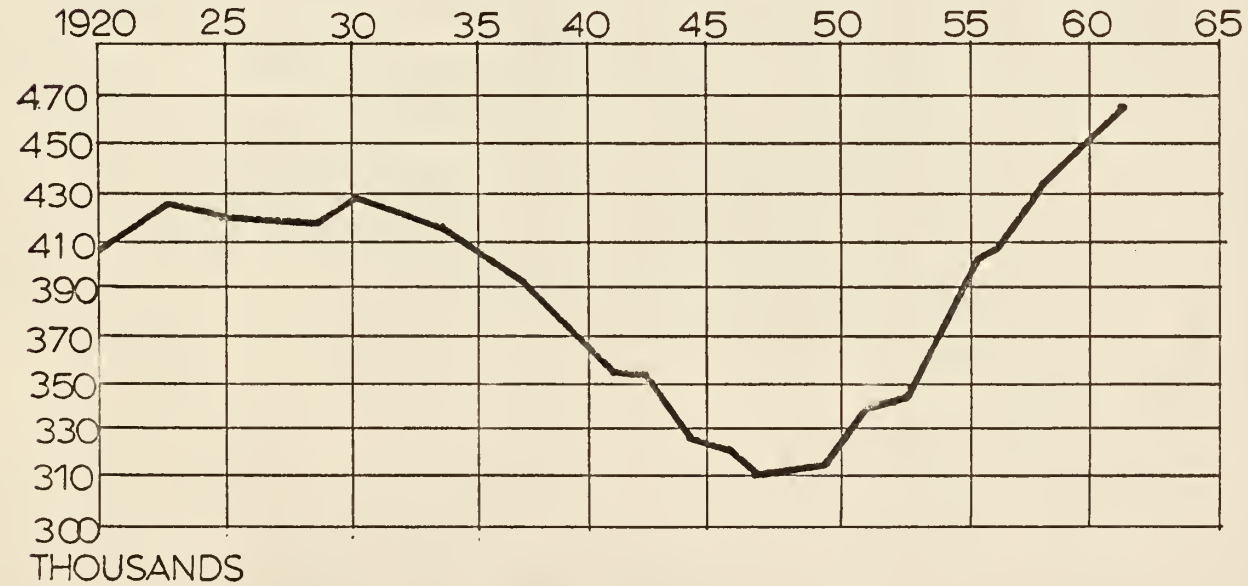


FIGURE 4
TOTAL ENROLLMENT IN KANSAS PUBLIC SCHOOLS
1920-62



While the school census is of value for state planning, it is of particular significance to the individual school districts. It is the only item regarding population which is gathered on the basis of school district boundaries. If accurately taken, it can provide valuable information for school planning in each district. For that purpose the number of children under five years of age is of particular significance.

The number of children to be educated is the important factor in determining the size of the school plant, number of teachers, extent of the educational program, and even whether a school should be maintained in a certain area or not.

An estimate of future enrollments made in 1963, by the United States Office of Education, predicts that in 1975 there will probably be 29,400,000 more pupils in the elementary schools (public and private) than there were in 1950, an increase of over 100 per cent. The total enrollment in 1975 may be 25,729,500 larger than that of 1950--a 115 per cent increase.[3] These figures indicate the stress which will continue to be placed upon the nation's school facilities.

According to the Comprehensive Survey of Kansas Education, the peak of public school enrollment in Kansas (422,189) was reached in 1923. The effect of the decline in birth rate during the last depression was felt in the elementary schools

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[3] Ibid.

in 1937 and in the high schools in 1941. The war also helped to bring a decrease in high school, and college attendance when military service, and industry drew heavily on older youths. High school enrollments are now increasing, and the elementary enrollment is also rising rapidly; these trends will continue in the years ahead.

Predictions of enrollments can never be made with certainty. Data on school census, number of births, and enrollment trends, provide useful clues, but unanticipated economic changes may upset the most carefully prepared predictions. The economic development of a state, and the characteristics of its population, largely determine the number and distribution of the children to be educated.

Enrollment predictions have been made for Kansas from 1938 through 70. The predictions indicate a rising enrollment trend in grades 1-8 throughout the prediction period, reaching a high of 372,230 in 1969-70. This total is 50,000 over the number enrolled in 1958-59. During the later year of the prediction period, the enrollments are expected to be relatively constant.

The enrollments in grades 9-12 are expected to increase each year during the prediction period, reaching a high of 151,050 pupils in 1969-70. This will be 39,000 more than the number enrolled in 1958-59.

These predictions emphasize the probability that the

growth problem will be most serious for the high schools. The larger numbers of children born in recent years are already in the elementary schools; thus these schools have already experienced much of the enrollment pressure. This enrollment bulge has now reached grades 7 and 8; but its full effect is yet to be felt by the high schools.

The enrollment of 523,286 in grades 1-12, predicted for 1969-70, is approximately 89,000 more pupils than were enrolled during 1958-59. This number represents an increase of 15.5 per cent in grades 1-8 as contrasted with 34.6 per cent in grades 9-12. Thus it is evident that the high schools of Kansas can anticipate serving four pupils for each three now enrolled.

In 1900, of the persons in the United States 5-20 years of age, 51.3 per cent were in school. The percentage has steadily increased until 71.5 per cent of this age group were in school in 1950. Kansas has consistently ranked above the national average, with 62.6 per cent of the 5-20 year olds in school in 1900 and with 75.5 per cent enrolled in 1940. In 1959-60, of the Kansas children 5-17 years of age, 91 per cent were in public schools as compared with 82.5 per cent for the fifty states and D. C., Kansas ranked fifth.

Three factors influence the number of children in school systems: (1) the number of children born, (2) the number living to be six years old, and (3) the holding power of the

school for the 12 year span of school life.

Population in rural Kansas has been declining since 1922. On-the-farm population, 468,000 in 1950 was down 360,000 in 1960, the lowest since the 1870's and only 17 per cent of the state's total population. The number of farms has continued to decrease, declining to 101,000 in 1964 in comparison with 161,000 a quarter century earlier. The average size of farms reached 494 acres in 1964 in comparison with 296 acres only 25 years before.

With continued substitution of machines for muscles, the number of "farm workers", including operators, unpaid family workers and hired workers declined from 186,000 in 1936 to 152,000 in 1963. However, the 49,900,000 acres, farmed by Kansas operators has changed little during the period; however it is down 600,000 acres from the high in 1954. The 101,000 farms in 1954 are the fewest since the 1870's, but the average size, 494 acres is an all-time peak.

In the wheat growing and cattle raising regions of Kansas, there has been a tendency for farm families to move to town, send their children to the local schools and carry on their farming operations from the town homes. This development has further decreased school population in rural districts and has swelled school enrollments in the elementary schools of the towns.

Industrial growth, federal installations, larger farms,

and the extension of oil and gas production have produced population shifts in certain areas which have been reflected in school enrollments. In the five-year period 1950-54 this shift was considerable.

The growth of cities has placed an increased pressure on existing school facilities, particularly in those of the elementary level, without taking into consideration the continuing increases in school population. Even more acute is the problem of providing school facilities for the thousands of children in the extensive suburban developments surrounding the larger cities. Pressure on high school facilities has just begun and will reach a peak within this decade.

Another major enrollment factor affecting the state is the shifting of pupils within the state and their concentration in a few areas. The problem is strikingly illustrated in Sedgwick, Wyandotte, Johnson, and Shawnee counties. These four counties enrolled 71,985 pupils in grades 1-12 in 1939-40. Ten years later, 1949-50, their enrollment had increased to 84,007. By 1958-59, however, their enrollments had jumped from slightly less than 20 per cent to approximately 37 per cent of total school enrollment in the state.

For the entire state the enrollments have increased 19.0 per cent since 1939-40 and 32.4 per cent since 1949-50. The three sections of the state have all shared in the increase. It has been 6.1 per cent for the western section, 34.2 per cent

for the central section, and 13.9 per cent for the eastern section. In the last nine years the growth has been 13.8, 40.3, and 30.5 per cent respectively for the three sections.

The changes in the enrollments reveal some interesting contrasts. In the past 19 years while the public schools enrollments of the state were growing by one-fifth, 71 or the 105 counties actually declined in enrollment. These counties are located in all sections of the state. In 16 counties the decline exceeded 40 per cent. Only 34 counties gained in enrollment during the 19-year period. The gains extended to a quadrupling of enrollment in Johnson County; four other counties more than doubled their enrollment during that period. The complete distribution of changes in enrollments by counties is shown in Table II and Table III.

TABLE II

NUMBER OF COUNTIES LOSING ENROLLMENTS

Per cent of change	Western	Central	Eastern	State
0 - 9.9	2	7	4	13
10 - 19.9	6	7	7	20
20 - 29.9	3	8	11	22
30 - 39.9	3	3	6	12
40 - 49.9	-	2	2	4
50 - 54.9	-	-	-	--
55 and over	-	-	-	--
Total	14	27	30	71

TABLE III

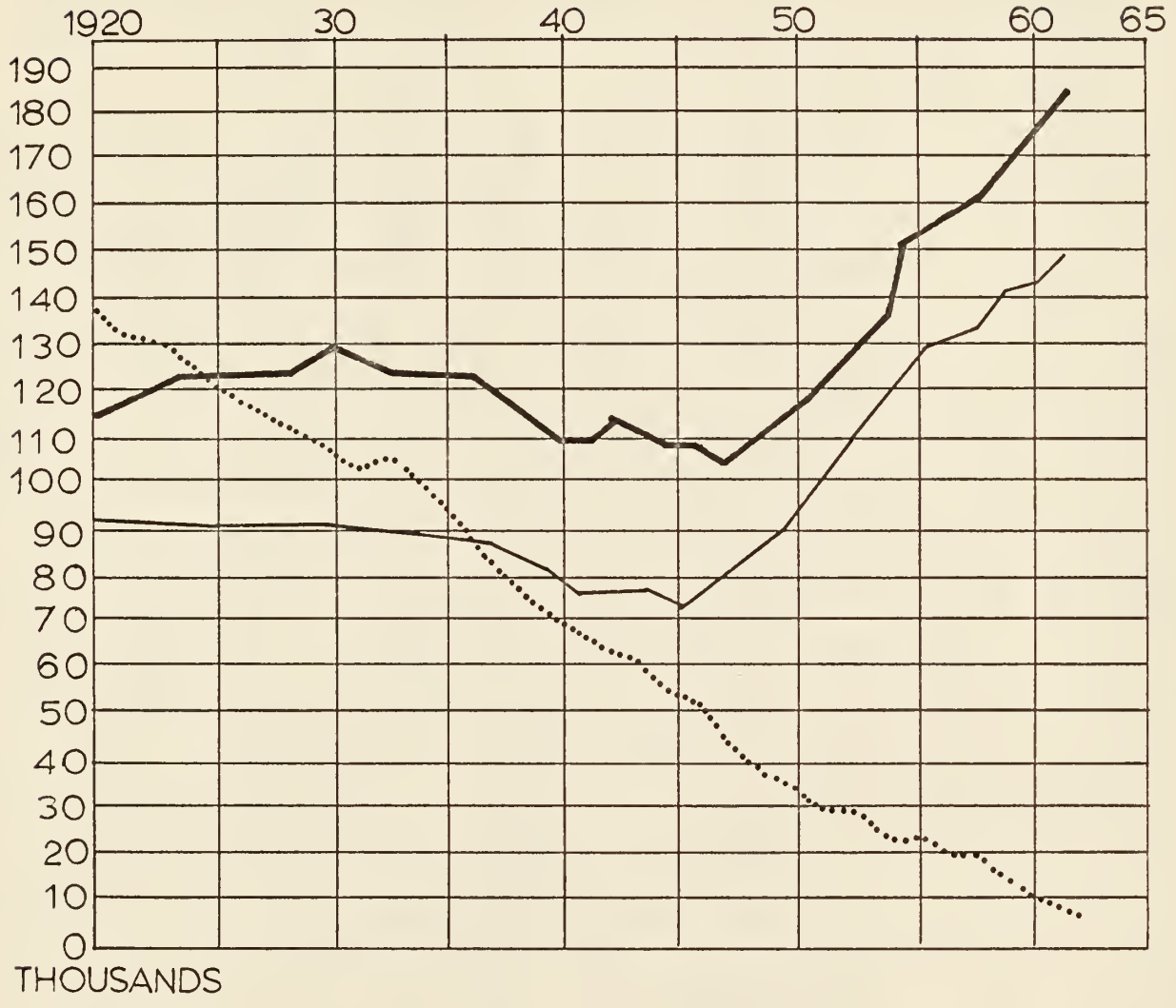
NUMBER OF COUNTIES GAINING ENROLLMENTS

Per cent of change	Western	Central	Eastern	State
0 - 9.9	3	-	1	4
10 - 19.9	3	5	-	8
20 - 29.9	2	-	1	3
30 - 39.9	3	1	2	6
40 - 49.9	2	-	2	4
50 - 54.9	1	1	1	3
55 and over	3	1	2	6
Total	17	8	9	34

In the summary, it is evident Kansas can expect a substantial increase in its public school enrollments. The larger number of births since 1947 (upwards of 51,000 per year) have already been reflected in sharply higher school enrollments. By 1969-70 an additional 89,000 pupils can be anticipated; this situation means that 15.5 per cent more pupils in grades 1-8 and more than twice that gain, or 34.6 per cent, in grades 9-12.

The task of serving these additional pupils is complicated by the changing pattern of school enrollments. The decline of the one-teacher rural schools has produced a pressure on the multi-teacher elementary schools. The larger per cent of pupils continuing through high school has swelled the secondary school enrollments and emphasized the need for

FIGURE 5
KANSAS ENROLLMENT TRENDS, GRADE 1-8
1920-62

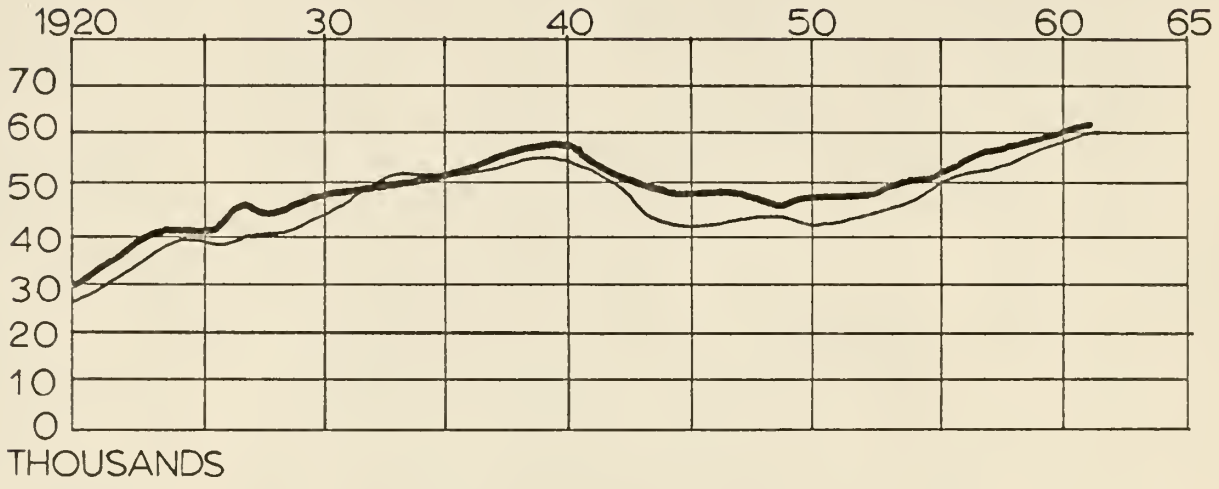


——— cities, 1st class and 2nd class

——— 2 or more teachers and 3rd class cities

····· 1 teacher schools

FIGURE 6
KANSAS ENROLLMENT TRENDS, HIGH SCHOOL
1920 - 62



——— HIGH SCHOOLS, cities 1st and 2nd class

——— all other high schools, includes rural and community high schools in first and second class cities

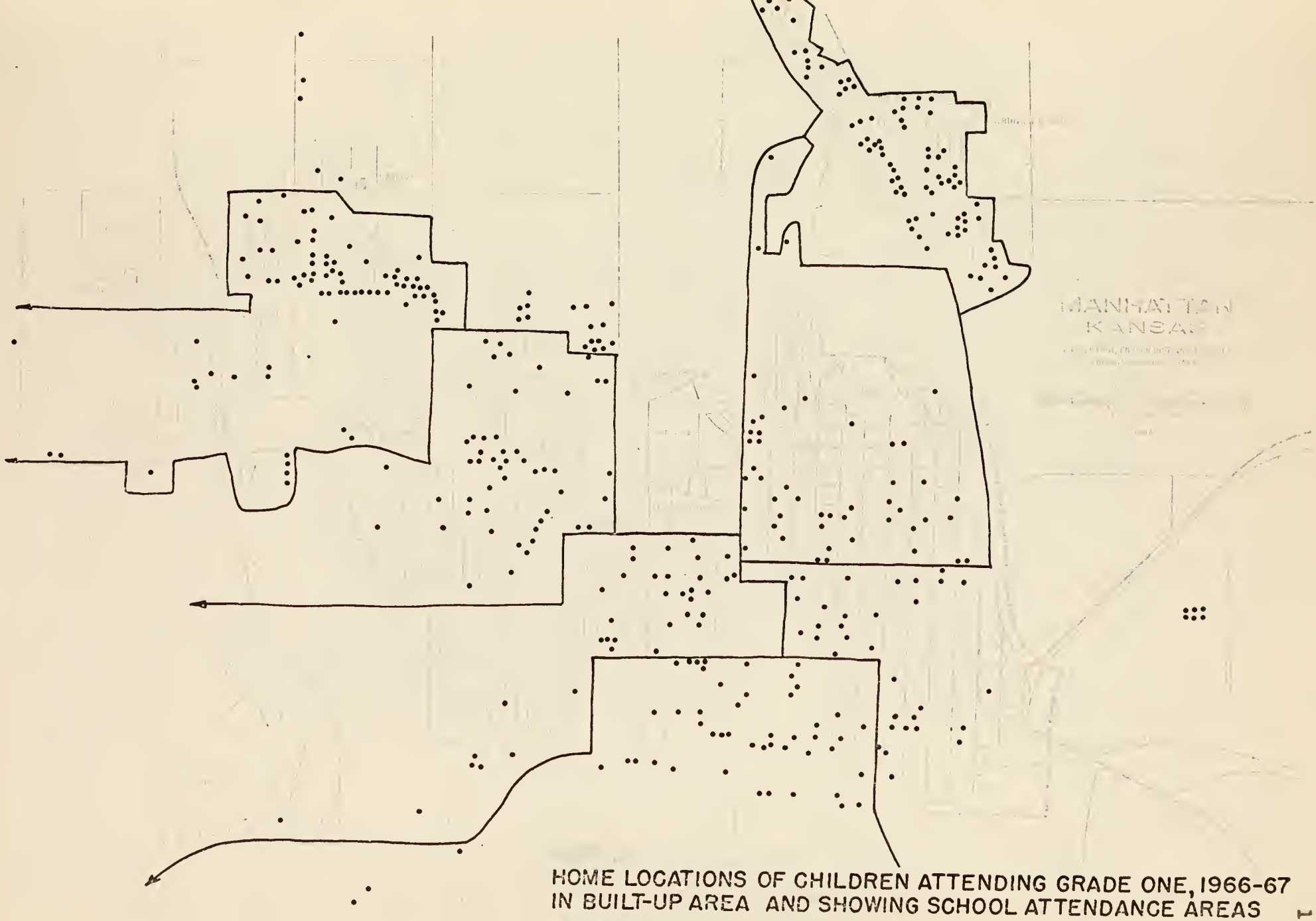
expanding the educational program to fit the varying needs of these additional pupils. The extensive shifts in enrollments among the counties has produced sharply different problems, depending upon the relative gain or loss. The contrast of having 36 counties declining in enrollment during the last nine years, while the enrollment of the state grew by one-third and six counties gained more than 50 per cent, illustrates the complexity of the enrollment situation and the problems which it produces.

CHAPTER III

THE PUBLIC EDUCATION IN MANHATTAN

The Board of Education of Manhattan has kept abreast of the problem of school planning by a program of continuing projections of schools space needs. These long-term growth pictures of the community schools include evaluation of the existing structures and potential enrollments. The "School Building Needs" report of June, 1961 was consumed with a complete study of all public schools, as well as considerations of the school enrollments. The study prepared by Engelhardt, Engelhardt and Leggett, Education Consultants, projected school enrollments and space requirements through 1972. In these projections, considerations were given to the new developments. A summary of the recommendations made in this report include the remodeling of the Junior High School, an addition to the Senior High School, an addition to the Northview Elementary School, and provision of new administrative facilities. The report recommended the purchase of a site for a new junior high school to be located northwest of the city, an elementary school site near Warner Park, and an elementary school site northwest of Marlatt School. Additional recommendations included additions to Marlatt School and the abandonment of the Douglas School.

The school district has made some notable advances in recent years. Libraries have been installed in all elementary



HOME LOCATIONS OF CHILDREN ATTENDING GRADE ONE, 1966-67
IN BUILT-UP AREA AND SHOWING SCHOOL ATTENDANCE AREAS

Figure 7

schools of sufficient size. These installations are an essential pre-requisite for strong programs for young people and are vital components for a reading program.

The enrollment indicated in Table IV shows an increase of about 1,500 students in ten years, or an average of 150 a year, exclusive of annexation.

The inclusion in the Manhattan district of the College Hill and Oak Grove districts is reflected in this increase but is not shown separately. The increase of 40 per cent, or 4 per cent a year, is impressive and indicates the strong effect on the community of the role of the growing Kansas State University, the heightened activity at Fort Riley, and the general high state of the economy in the area. The full effect of the Tuttle Creek Dam and its impact upon Manhattan has not yet been felt. Further growth from the area, because of its many advantages, can be expected.

TABLE IV

PUBLIC SCHOOL ENROLLMENTS BY GRADES

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PUBLIC SCHOOL ENROLLMENTS BY GRADES

Grades	'57-'58	'58-'59	'59-'60	'60-'61	'61-'62	'62-'63	'63-'64	'64-'65	'65-'66	'66-'67
K	453	458	444	475	512	508	432	474	572	544
1	332	417	410	379	420	475	383	414	483	549
2	329	321	399	383	411	407	378	377	449	453
3	306	327	316	369	400	404	347	362	436	449
4	368	293	322	324	352	377	317	386	441	437
5	305	296	295	315	334	339	349	325	450	448
6	269	299	274	279	287	341	333	358	487	447
7	215	296	321	373	299	335	336	360	413	392
8	251	222	283	317	328	304	318	348	417	413
9	255	282	248	310	310	383	335	362	383	390
10	209	248	275	239	245	300	315	340	353	387
11	185	206	237	257	261	343	346	320	337	355
12	168	170	202	226	235	254	293	350	355	325
Total	3,545	3,835	4,026	4,146	4,394	4,670	4,482	4,776	5,776	5,476
Special Cl.							24	40	50	70
Grand Total							4,506	4,816	5,526	5,659

TABLE V

ENROLLMENT BY GRADES AND SCHOOLS[a]

School	Special Education	K	1	2	3	4	5	6	Total
Bluemont		60	48	50	60	46	46	44	354
Eugene Field		58	17	30	39	40	45	49	378
Green Valley		6	13	8	10	5			42
Lee	17	46	50	43	55	46	59	54	370
Lee Annex	With Lee								
Marlatt		76	81	59	60	60	80	67	483
Marlatt Annex		41	28	30	22	22			143
Northview	30	96	80	72	62	55	45	56	496
Ogden		38	58	41	32	36	34	34	273
Strong			14	8	8	12	8	10	60
Theodore Roosevelt		63	59	46	45	51	54	59	377
Woodrow Wilson		61	64	55	43	54	60	65	402
Total	47	545	512	442	436	427	431	438	3,278

	7	8	9	Total
Junior High School Grades	389	416	389	1,190

	10	11	12	Sp. Ed.	Total
Senior High School Grades	380	349	320	10	1,059

[a]Engelhardt, Engelhardt and Leggett, Education Consultant. "School Building Needs, Manhattan, Kansas," 1961.

TABLE VI

APPROXIMATION OF ENROLLMENTS FROM AREAS THAT JOINED WITH MANHATTAN AS OF THE FALL OF 1966-1967[a]

	K	1	2	3	4	5	6
Ogden	38	58	41	32	36	34	34
Strong		14	8	8	12	8	10
Green Valley	6	13	8	10	5		
Bused Student							
Northview	5						
Woodrow Wilson	6	11	13	8	10	16	16
Theodore Roosevelt	3	4	5	2	3	2	2
Total	58	100	75	60	66	60	62

[a]"School Building Needs, Manhattan, Kansas," 1961.

TABLE VII

COMPARISON OF EARLY ESTIMATES OF ENROLLMENT EXCLUSIVE OF EFFECT OF THE REORGANIZED DISTRICTS[a]

Grade	1964-65	1965-66		1966-67	
	Actual	Estimated	Actual	Estimated	Actual
K	474	496	471	462	486
1	417	423	482	443	449
2	377	393	366	385	378
3	362	370	344	369	389
4	386	356	380	348	371
5	325	390	366	345	388
6	358	341	330	390	385
Total	2,696	2,769	2,739	2,742	2,846

[a]"School Building Needs, Manhattan, Kansas," 1961.

The 1965-66 estimates of enrollments for the old Manhattan district were quite close to actual enrollments. In 1966-67, the enrollments were between 3 and 4 per cent over the estimates and the differences were scattered throughout all the grades.

TABLE VIII

INCOME TRENDS OF RILEY COUNTY

	1950	1960	Percentage of change
Population	33,405	41,914	+25.5
Number of families	7,390	9,205	+24.5
Median family income	$2,732	$4,746	+ 7.4
Income less than $2,000	31.2%		
Income less than $3,000		23.2%	
Income over $5,000	15.5%		
Income over $10,000		8.6%	
Number of persons employed	9,700	12,358	+24.5%
Per cent of total population employed	29.0%	29.6%	

FIGURE 8
POPULATION PREDICTION OF MANHATTAN

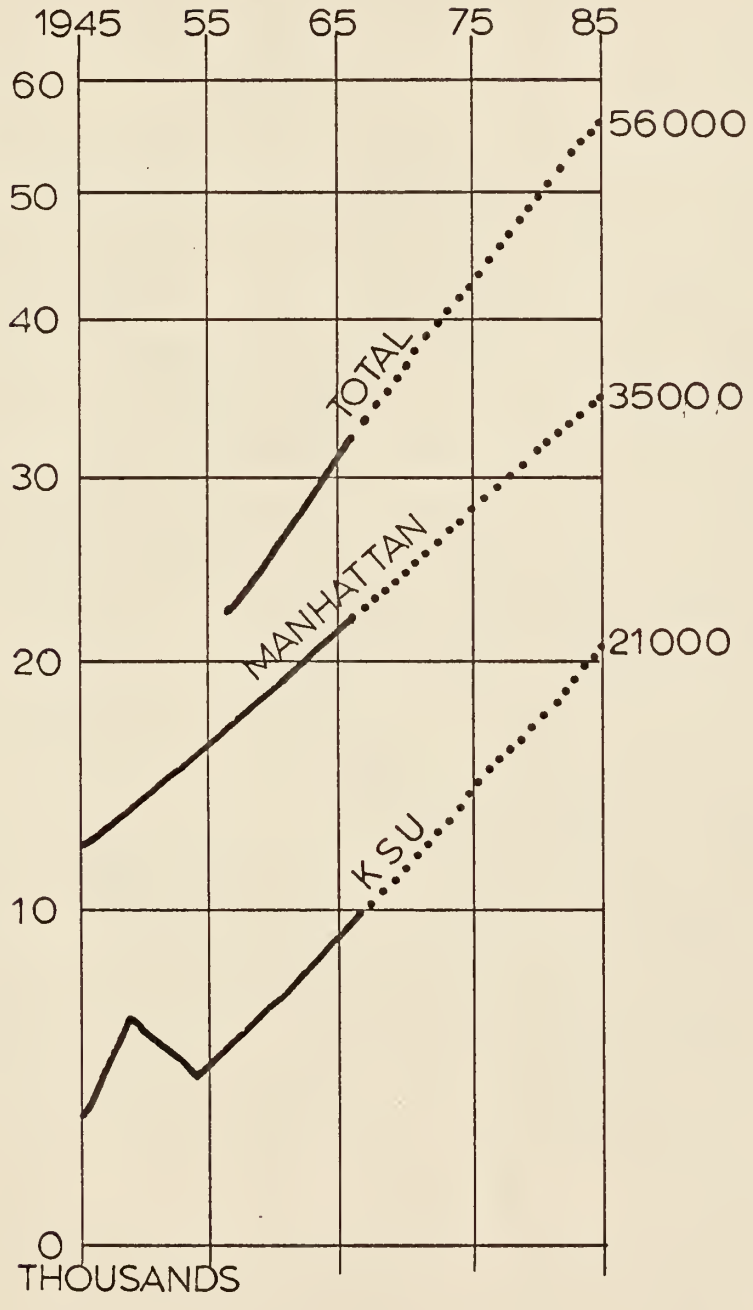
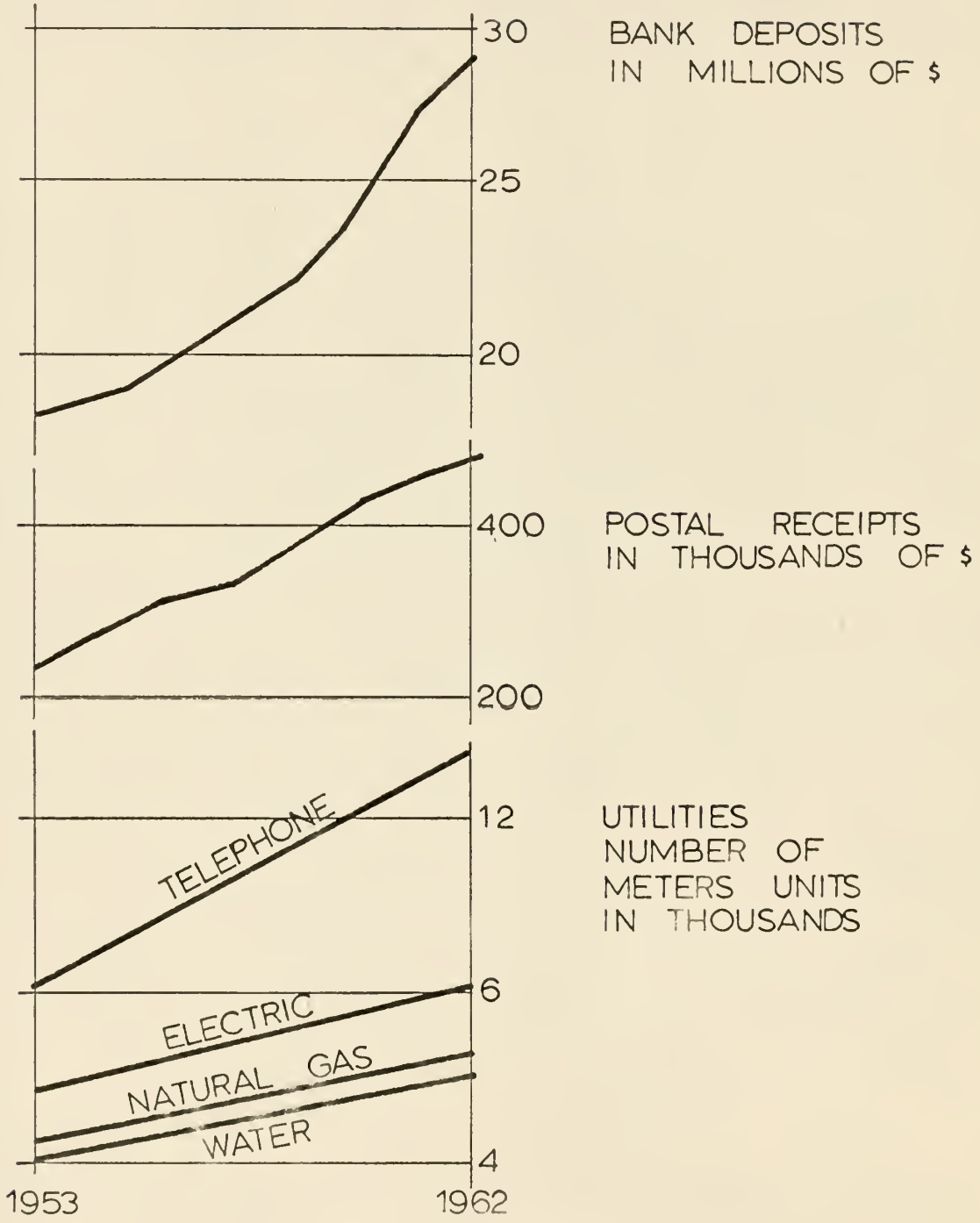


FIGURE 9

ECONOMICAL GROWTH OF MANHATTAN



The actual number of births in relation to residents of the district continues to drop slightly. Aside from the peak year of 1957 and the subsequent high year of births in 1958, with the total of each year around one thousand, the birth ratio now are in the low 700's, a slow decrease each year from the high points. It is doubtful that the births will rise dramatically in the reasonable future. There has been some expectation of a reversal of the lowering birth figures when the large baby crop of the Post World War II boom become parents. It would seem that the re-occurrence of a vogue for large families is not to be expected and that the total increase in population of the United States will proceed at a more moderate rate.

TABLE IX

THE BIRTH RATE OF MANHATTAN

Year	Number of live births to residents of Manhattan
1956	804
1957	1,006
1958	982
1959	847
1960	889
1961	825
1962	835
1963	790
1964	749
1965	718

Using births to residents of Manhattan and a review of the movement of classes from grade to grade, tempered with

judgment, one may use a set of estimates of enrollments that has been made. These estimates are shown in Table X and Table XI.

TABLE X

ESTIMATES OF ENROLLMENT BY GRADE GROUPS

Year	K-6	7-9	10-12	Total
66-67 actual	3,327	1,195	1,024	5,546
67-68	3,389	1,293	1,064	5,746
68-69	3,401	1,348	1,156	5,905
69-70	3,430	1,426	1,162	6,018
70-71	3,483	1,437	1,260	6,180
71-72		1,441	1,315	
72-73		1,490	1,413	
73-74		1,552	1,404	
74-75		1,624	1,408	
75-76		1,620	1,457	

TABLE XI

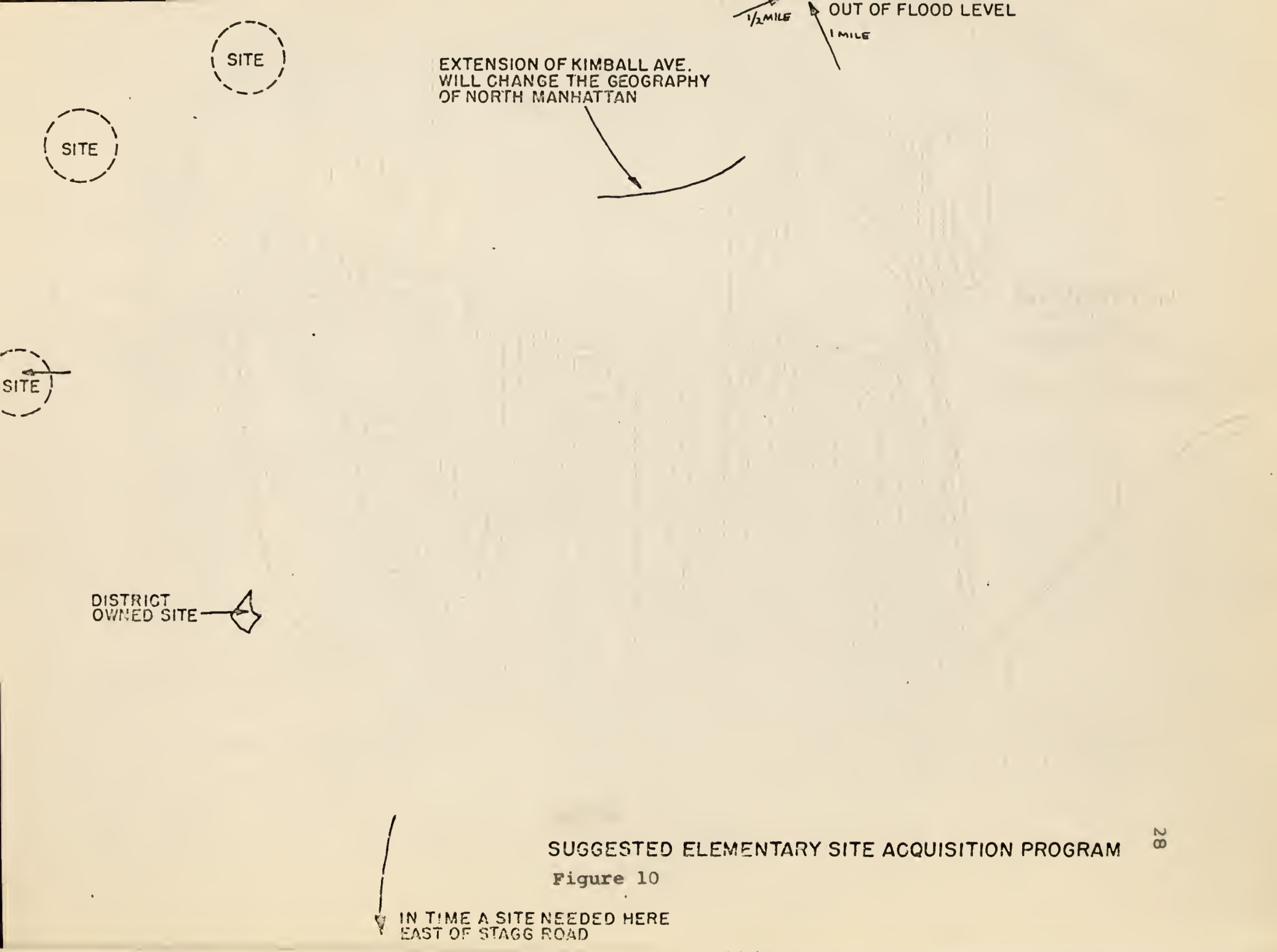
ESTIMATES OF ENROLLMENT BY GRADES[a]

TABLE XI

ESTIMATES OF ENROLLMENT BY GRADES[a]

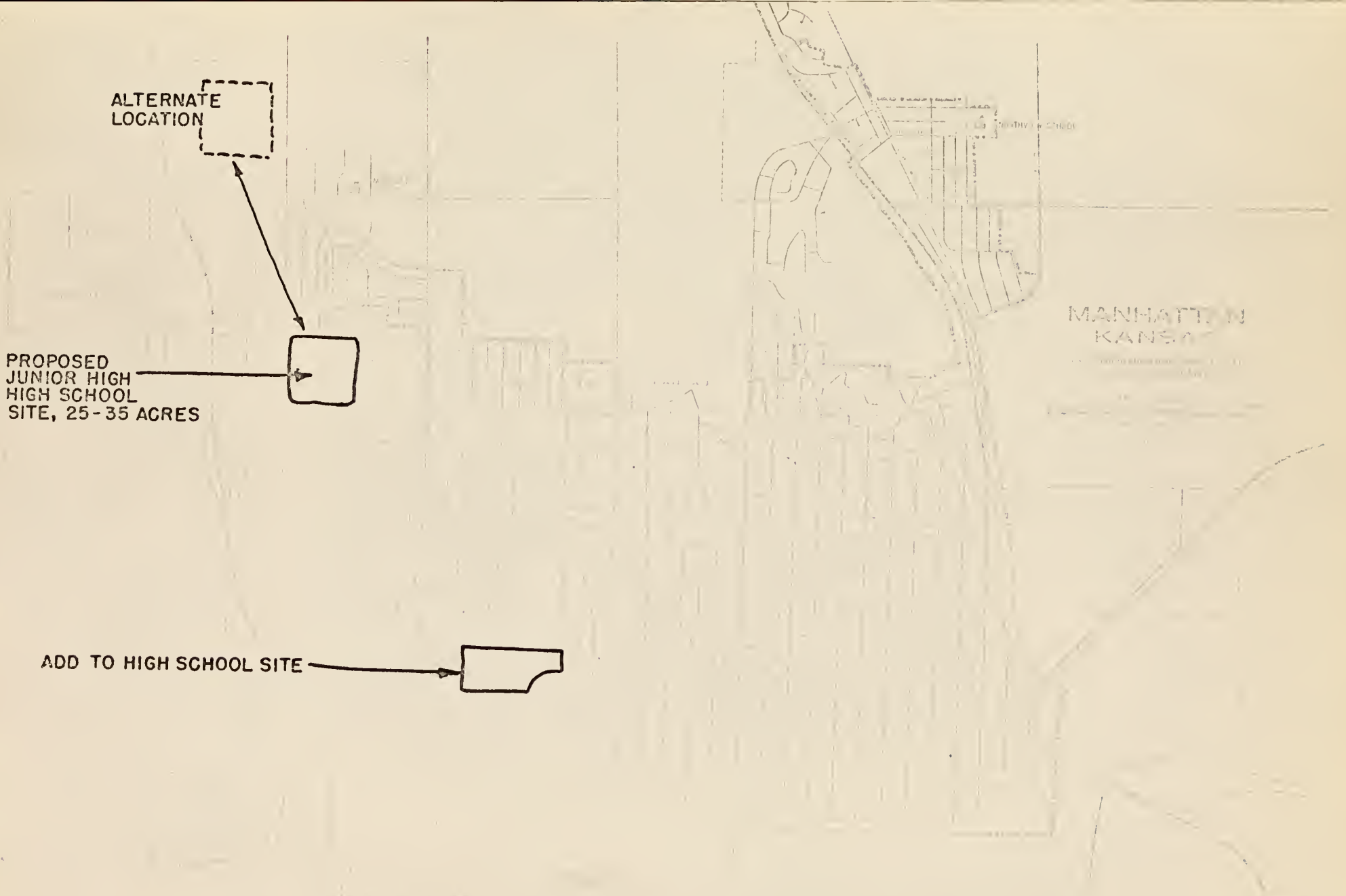
Year	K	1	2	3	4	5	6	7	8	9	10	11	12
66-67 Actual	544	549	543	449	437	448	447	392	413	390	387	312	325
67-68	551	520	529	453	448	440	448	477	392	424	380	377	307
68-69	521	530	500	520	452	438	440	468	477	403	414	370	372
69-70	520	501	510	500	519	442	438	470	468	488	393	404	365
70-71	520	510	490	510	502	509	442	468	490	479	378	383	399
71-72		540	520	500	508	500	509	472	468	501	369	468	378
72-73				510	500	514	500	539	472	479	491	459	363
73-74					509	505	514	530	539	483	469	481	354
74-75						514	505	544	530	550	473	459	376
75-76							514	535	544	541	450	463	454

[a]"School Building Needs."



SUGGESTED ELEMENTARY SITE ACQUISITION PROGRAM

Figure 10



SUGGESTED SITE PROGRAM - SECONDARY SCHOOLS
Figure 11

CHAPTER IV

A NEW CONCEPT IN EDUCATION

Every child or youth needs to communicate effectively with others through his own language, in speaking, reading and writing, and to acquire understanding, skills, attitudes and an appreciation of mathematics to enable him to use effectively those tools in daily living and to gain skill in problem solving to develop a capacity to make sound judgments.

He needs to improve and maintain physical and mental health, and to be able to make intelligent decisions about personal, home and community health problems.

He needs to understand the elements inherent in satisfying relationships of husband and wife, or parents and children among themselves and of members of the family with each other, and to have a desire that these relationships be creative in relation to all persons involved. Furthermore he needs to acquire the understandings, skills, and appreciations basic to effective personal and family living in a home.

He needs to enjoy literature, art and music; to acquire skill in foreign languages for communication and cultural activities as a means of personal enrichment and creative world social interrelationships; to understand both the social and physical world in which he lives and to be able to see and make use of the relationships and interactions between

science and invention on the one hand and the current social, economic, and cultural life on the other.

The social and technological changes occurring in the past ten years exceed in scope those occurring in the 500 years prior to the colonization of America. The rapidity of change is such that what was held as true yesterday may be discarded today. The student today wants, needs and actively seeks an education to prepare him to cope with problems he meets in an increasingly complex society--a society much more complex than the world in which his parents grew up.

Keeping pace with the times is possible only as there is continuing progress in the ability of people to understand what changes are occurring, what they mean, and how man may adjust intelligently to them. It is evident the period of anticipated service from the schools must be lengthened so that it extends from early childhood into adult years.

The knowledge and understanding, skills and abilities, and attitudes and appreciations necessary for effective sharing as a citizen in a democracy today are vastly different from those of earlier times. A broader, deeper program must be provided, focused on both the needs of the individuals in our complex world and on the need of the state for intelligent citizens.

Such a program will be pupil centered. It will be planned about major life activities. It will show due regard

for uniqueness and for initiative. It will develop high respect for individuals as persons, respect for law and order, a sense of social responsibility and a skill in cooperation.

Whatever form the curriculum takes, it reflects the aims and purpose of some segments of the society. Culture embraces all modes of thought and behavior that are handed down by communicative interaction--that is, by symbolic transmission--rather than by genetic inheritance. It is what a person learns from others through speech, gesture, and example, and as opposed to what he acquires through heredity.

Modes of thought and behavior peculiar to a given culture and transmitted by communicative interaction thus constitute the content of the culture from which a school selects content for the curriculum.

A curriculum, in order to be effective, must be implemented through the activities of a teacher of a school. Some of the conventional means are the lecture, class recitation, or laboratory demonstration. The self-contained classroom is another familiar form of organization for implementing the curriculum. New approaches, especially in the application of technology to education and in school organization, have been increasingly utilized. The initial effect has been to generate new thinking about vitalizing the teaching-learning situation.

A class of 25 is unnecessarily small for large-group instruction activities. Not only is the size financially

uneconomical, but it also means deadening repetition for teachers who must go over the same materials for several sections. Moreover, because classes are limited from 25 to 35 students, present teaching schedules usually require a teacher to conduct 25 (or more) classes a week. With a teacher's other activities, this situation leaves insufficient time for preparing instruction plans, developing imaginative use of teaching materials, counseling individual students, evaluating students, and keeping professionally up-to-date.

Today's class of 25 to 35 is too large for effective study. Freedom of movement, independent creative activity, and development of student responsibility for learning are difficult in a group of this size. The class of 25 to 35 is also too large for successful discussion. Research in group process indicates that a group cannot be larger than 12 to 15 if there is to be effective participation of all its members.

The body of knowledge with which our society must cope has increased at a staggering rate since the turn of the century. Both the learning and teaching techniques and facilities have been left behind. If more of this knowledge is to be made available to the student through our schools, a rearrangement of curricula and teaching techniques will be necessary.

Both quality and quantity of our teaching force have grown enormously in the last 25 years. But the size of the

teaching force has not kept pace with the demand of the exploding student population. There is no indication at present that there will be an adequate increase in the number of teachers available to match the upward spiral of enrollment figures which may be clearly calculated for the years to come.

Tomorrow's students at all ages will take on more responsibility for their own learning. More attention will be given to the individual pacing of a student's study program according to his ability and readiness to learn.

Decisions will be made concerning relative time to be spent, sequences, and the most appropriate learning activities and resources. The decisions will take into account the differences among individuals, groups, and subjects. Such consideration will develop a variety of study patterns. There will be frequent regroupings of students in order to cope with the differences in abilities, interests and needs. Flexibility of grouping will be a key characteristic. Individuals will not necessarily be placed in a single group for an entire year, nor even for a semester.

The school of tomorrow will schedule students in class groups for an average of only 18 hours a week, instead of the present 30 hours. Twelve of the 18 hours will be spent in large-group instruction (100 or more students) and six will be spent in small-group discussions (12 to 15 students). In addition to these 18 hours, the average student will be

scheduled for about 12 hours a week in individual study.

Students who do not have out-of-school jobs or heavy activity schedules often will spend as much as 20 or 24 hours weekly, instead of the average 12 hours, in individual study. The number of hours and locations of independent study will vary with the needs and the capacities of individual students. By the use of recommendations of teachers and counselors, individual schedules will be worked out by electronic devices.

Major changes in the pattern of utilization of our teaching skills will take place in response to the pressing demand of a situation. Increasing use of instructional aides, clerical assistants, and other non-professional personnel will help to free teachers for teaching. The most advanced communication devices at our disposal--especially television--hold great promise for making available the abilities of our leading teachers to inspire students.

Audio-visual equipment will be available in a price range that will make it feasible for the comparatively small school to own its own equipment. On this basis, the small school will set up its own distribution program on its own schedule, drawing from a taped library of lessons to fill what ever gap may appear in its curriculum.

CHAPTER V

A NEW TEACHING-LEARNING PROGRAM

An underlying purpose of the school will be to develop ability to study, think, and solve problems, in contrast to today's emphasis on memorizing facts. In large groups small-group discussions, and individual study, the emphasis will be put on the goal of helping a student develop the ability to solve problems on his own.

At all levels of elementary education steps will be taken toward more individualized attention to a student's needs and abilities. Team teacher techniques will bring the student into contact with more than one teacher. Several teachers will share the responsibility of the schedule, each handling the area of teaching for which he or she is better qualified.

Increased teacher specialization from grade 4 and up will be especially important. Rather than remaining in one space all day long, the student and (or) teacher in the primary grades will be more inclined to move about in the school plant. A greater variety of school spaces will be required. Sometimes children will be grouped with students other than those in their class, either in larger or smaller groups.

More attention will be given to humanizing the elementary school and its spaces. Since the youngster from 6-14

is extremely impressionable, the trend will be away from the "institutional" appearance. Tomorrow's secondary school will take into account current concern with growth in size, enrollment and loss of student teacher contact.

The secondary school of tomorrow will not have standard classes of 25 to 35 students meeting five days a week on inflexible schedules. Both the size of the groups and the length of the classes will vary from day to day. Methods of teaching, student groupings, and teacher and pupil activities will be adjusted to the purposes and content of instruction.

No longer will one teacher endeavor to be in charge of all of a class' activities in one subject. Instead, teaching will be organized to be more efficient and effective.

Some aspects of learning will be presented by especially qualified teachers to relatively large groups of students. This procedure, in turn, will provide more opportunities for students to explore ideas in small discussion groups. Some classes will be much larger, to permit the student to learn to assume more individual responsibility for learning.

The student will carry more responsibility for self-initiative, as he will need to do when he goes on to college. His motivation toward accepting this responsibility will be encouraged by increased small-group instruction and counsel.

By readjustment of the grouping pattern, a teacher will have an opportunity to meet with more students and still have

more time for preparation of lessons. With the help of electronic devices such as language laboratories, television, etc., expert teachers will be shared by more students. Team teaching procedures will utilize the individual teacher's particular skills more effectively.

Spaces in the school will be designed for activity in more varied group sizes--for the individual, small groups (4-5), seminar groups (10-15), more traditional groups (25-35) and large groups (50 and up).

Highly individualized teaching and guidance is the great advantage of the 1:1--1:6 teacher-student ratio. Instruction in small groups, is subordinated to motivation of the student-motivation first to ask the question and second to seek his own solution. Here the teacher's most valuable function is encouragement of the student to help himself.

In the seminar-type (12-15) group, a teacher is perhaps most valuable as a catalyst. As in very small groups, here the teacher tends to lead the students rather than instruct. Close contact between one student and another (with or without a teacher present) allows for development of "team learning".

More specialized skills in teaching are necessary with more explicit attention to preparation of instructional material since there is less occasion for give-and-take between teacher and student. Many educators debate the real immediate instructional value of student participation in large groups except

for delivery of planned presentations.

Teacher emphasis for a large group is on instructional material in the subject area. Teaching aids are extremely important for both audio and visual demonstration or amplification in large group delivery. Teaching teams (a lead teacher plus support teacher and (or) clerical aides) will be used in teaching such groups, often supported by televised programs of instruction and other audio-visual aids.

These large-group activities will occupy about 40 per cent of the students' time. The amount of time spent in large groups will vary according to subjects, to different stages in presenting a subject and in accordance with student interest and maturity.

Students will engage in study activities as individuals, or in groups of two or three, with a minimum of constant supervision. Teachers and other staff personnel will serve more as consultants than as task masters. Conferences between students and instructors will be held whenever necessary to clarify goals, content, and personal problems.

Students will read, listen to records and tapes, view experiments, examine and consider evidence, analyze, investigate, think, write, create, memorize, record, observe, and make self-appraisals of himself. These activities will take place in project and materials centers, museums, workshops, libraries, and laboratories in and outside of the school.

Study activities will require students progressively to take more responsibility for self-direction (40 per cent of their time). Small groups of 12 to 15 students and a teacher will put mind against mind to sharpen understanding. They will examine terms and concepts, solve problems, and reach areas of agreement and disagreement.

At the same time they will learn about getting along together. This objective is primarily a student activity with the teacher sitting in as counselor, consultant, and evaluator. The discussion activities will occupy about 20 per cent of the student's time.

The design of a school, its spaces and its facilities must permit the development and the support of the educational function.

Two or three large-group spaces will be included in most well-planned schools of the 60's. These spaces will be designed for great versatility of grouping arrangements. Library, music rooms, arts and crafts room, little theater, playrooms, will all fall into this category. Proper choice of furnishings and proper installation of audio-visual resources will be necessary for the effective functioning of the spaces. Intelligent multiple use of some of these spaces will be common.

Outdoor spaces will be protected from encroachment of the flow of asphalt and cement. Especially where climate

allows, outdoor provisions will be made for academic as well as physical education.

Individual study spaces for 1 or 2 students, with or without the presence of a teacher, will be almost everywhere in the library, a special area set apart in a larger class-rooms, a sound protected booth, a laboratory or shop, a teacher's office, etc. Tools for self-instruction should be accessible--books, lab equipment, sound recorders, television, drawing materials, projectors, etc.

Seminar spaces for 12-15 students will be common facilities in the secondary school. Conferences in the seminar rooms will be more casual, less restrictive than those in standard class rooms, providing spaces and facilities for work projects and teaching aids. Partitioning devices should allow expansion or enclosure of space-within-space.

Classrooms for 25-35 students will be included in most new school plans to satisfy more conventional teaching techniques. If these rooms are either conventional rectangles or a less conventional shape to better accommodate their function, they can be so arranged as to allow for combinations into large-group rooms for 75-150 students; moving partitioning devices capable of satisfying problems of sight and sound will make the conversion possible. Large-group arrangement will allow for lecture-type instruction, televised instruction with multiple screens and the uses of other team-teaching techniques.

Large multi-purpose area for 150 or more students will accommodate groups for lecture, demonstration and televised instruction. Additional use of space for cafeteria, auditorium, little theater, music room, library, study area, etc., is indicated for efficiency in use of space. Acoustic planning and freedom from visual obstructions are important. Sub-divisibility of the auditorium may or may not be necessary, according to the size of the entire school unit.

Other necessary facilities such as those currently required will be given more detailed attention in planning both for efficiency in use of space and for more pleasant environmental effects.

Outdoor spaces will be utilized more often as teaching-learning areas. Attractive exterior treatment of the spaces around the school has great value in bolstering student and community pride.

Television studio facilities for originating programs as well as short-run transmission from video tape and film will be included in many new schools. Studios will vary in complexity according to the needs of the school program. These may be built into one school, shared with several nearby schools linked together by transmission cables.

CHAPTER VI

DESIGN CONCEPT AND DESCRIPTIONS

Flexibility is the key word for planning a school plant in order to meet the everchanging educational principles and the everchanging needs of children. That is to say the rapid change of the size of spaces and configurations by virtue of movable partitions which can be done by the school maintenance crews, and immediate flexibility achieved simply by the installation of furniture and furnishings that can be moved or removed. Also the possibility of future expansion should be put under consideration.

A student has more to learn in the classroom today than in the past, and the environmental factors in a school building can do more to aid or handicap him than ever before. If he is to devote his full effort to the task of learning, he should not have to waste energy in combating the discomforts of bad lighting, noise, cold air and draft, nor should he be exposed to the hazards of unsafe or unsanitary conditions. A modern school building must be comfortable, healthful, and safe to be of value to education.

I. THE CHILD DEVELOPMENT LABORATORY

The Site

The Child Development Laboratory is affiliated with the Department of Family and Child Development at Kansas State University. The location is preferably close to the Department. The site selected for the laboratory is located on the campus of the university between Campus Creek Road and the parking lot for Justin Hall. Tall oak and ponderosa pine trees cover the east part of the site.

The Program

There will essentially be two groups of children at age three to four in the nursery school. The activities will mainly be indoor and outdoor playing, story telling, and creative activities. Meals will be served if any of the group stays more than four hours. The college students in the Department will be engaged in helping the full time teacher in the playroom and the playground, observing childrens' behavior, research, group discussing, etc.

Design Descriptions

Playground. The playground is located at the east side of the building, with a fence all around and doors at both ends. There will be a covered and paved area for wheel toys. A storage room will serve this area with a direct access.

Playrooms. The playrooms are planned based on 30 square feet per child of useful floor areas. Two playrooms are needed at a capacity of 15 children each. In each room, there will be a place for dramatic play, i.e., a doll room or a little house, a place for creative painting and clay molding, etc. The playroom floor is carpeted except for the tiled working area. For every child there will be a locker for his coat and belongings. These will be identified with different colors. General storage is located between the playrooms.

Children's toilet. There will be one toilet for each playroom. This will be so placed that it will provide convenience for both the playroom and the outdoor playground.

Entrance lobby. A checking stand is placed in the reception area for checking children in the morning. There will be a place for parents and children to sit while waiting for a conference with the school nurse.

Administration. A general office for the director of the nursery school and full time teachers is located adjacent to the entrance. A conference room and an isolation room are also included in the administrative suite.

Multi-purpose room. Small group activities will be held in this room. Meals will be served from the kitchen next door.

Observation area. Observation area will be located on the first floor in the corridor and on the mezzanine between the playrooms.

Research and teaching facilities. The teaching learning and research area for the college students will be located on the second floor.

Parking. There will be a parking lot for parents on Campus Creek Road. Staff and college students will be using the parking lot behind Justin Hall.

Construction and Material

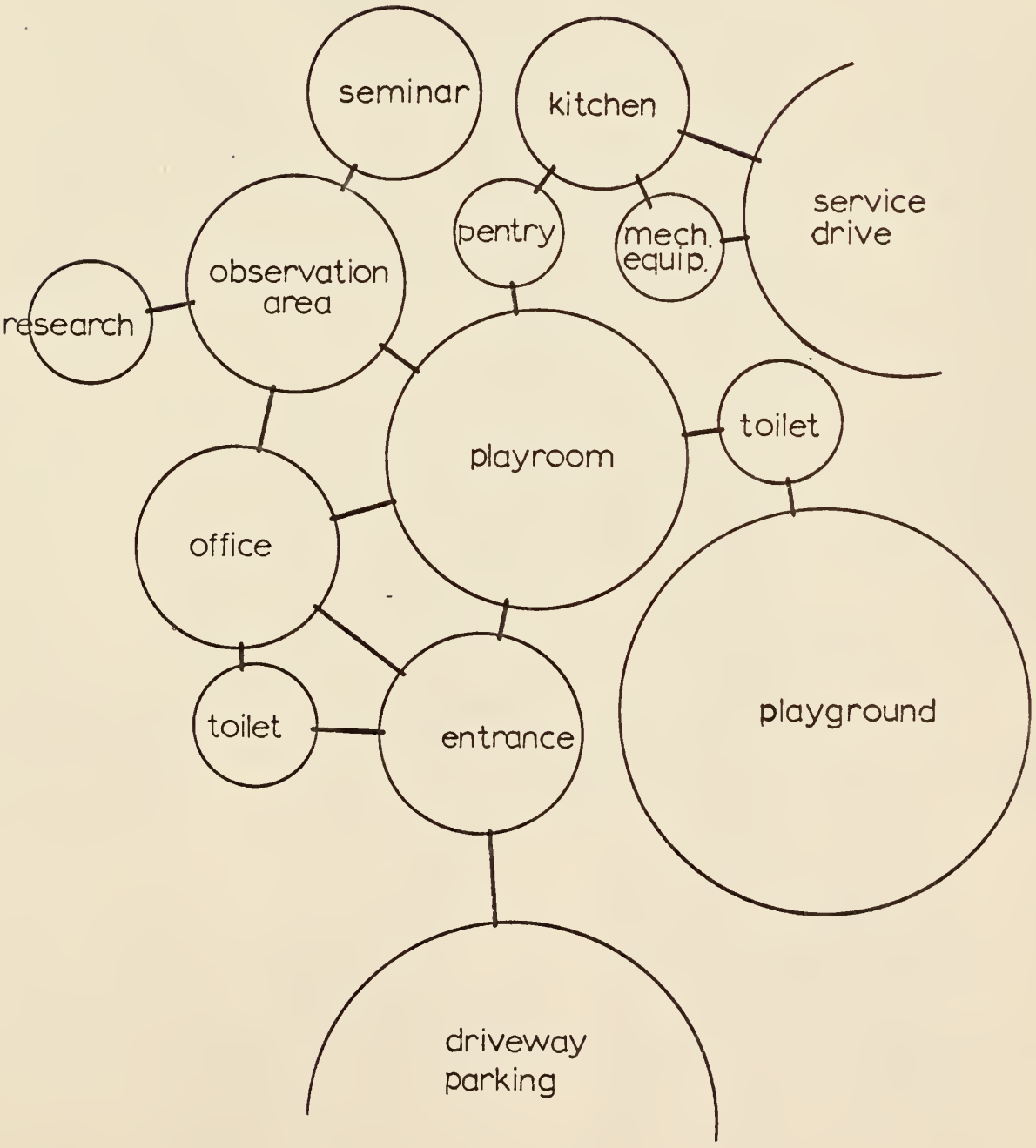
A series of hexogonal inverted hyperbolic pareboloid umbrellas each with a 20 foot diameter will be cast with reinforced concrete as the roof system. The exterior walls will be of red brick and will contain the vertical vision window units.

II. THE ELEMENTARY SCHOOL

The Site

The school district of Manhattan owns this piece of land in the newly developed residential area near Warner Park. The property borders Amherst Avenue, Research Drive and Dartmouth Drive. There is a 75 foot elevation difference and a very steep bank cutting the site into two relatively flat areas. Natural stones are scattered over the entire site.

FIGURE 12
FUNCTIONAL ANALYSIS OF
THE CHILD DEVELOPMENT LABORATORY



The Program

The elementary school will be serving 450 students from kindergarten through grade six. The kindergarten will be a separate self-contained unit. Students of grade one through six will be integrated in a teaching-learning complex where numerous activities such as individual study, small group, medium group and large group instruction will be held, based on a non-grade system.

Design Descriptions

Kindergarten. A minimum of thirty-five square feet per pupil is planned for the kindergarten playroom. Working benches, a play-kitchen, book shelves, tables and chairs will be arranged in groups so as to provide group activities areas without interfering with each other. There will be a direct door to the playground. There will be separate toilet rooms for boys and girls. Sinks with attached drinking fountains will be placed in the playroom with a mirror above them.

Grade one through six. There will be a large instructional area for general classroom activities. With the use of operable partitions and proper arrangement of furniture, single and team teaching, small groups, medium groups, large groups and individual study areas are made possible. Chalk boards, working counters, book shelves and tables will be so designed and placed that a maximum freedom is reached for

rearranging the room.

The resource center. The resource center is located adjacent to the common instructional area. It is composed of a reference area, a working area and reading area. A circulation desk will be located at the center for easy access and supervision. Individual study carrels are available in this area.

Special classrooms. Five classrooms will be located near the common instructional area and the resource center. Certain classroom activities such as using audio-visual material requiring darkening the room and chemical reaction demonstrations, with its distracting noise and odors will be held in these special classrooms. The two large self-contained rooms could be designated for the first grade use in case the school board found it necessary to do so.

Multi-purpose room. A divisible room will be used for physical education, lunch, and other activities. Kitchen and general storage will also be provided.

Lecture hall. A lecture hall with three hundred seats is needed for large group instruction, indoor assemblies, dramatics, music education, and other activities.

Administrative suite and teachers' complex. The administrative suite consists of the principal's office, general school

office, health office, guidance, and general storage. The teachers' lounge, working room, and toilet will be centrally located in this school building. Two small offices will be provided in this area for teaching specialists.

Boys' and girls' toilets.

Custodial closets.

Outdoor playground.

Construction and Material

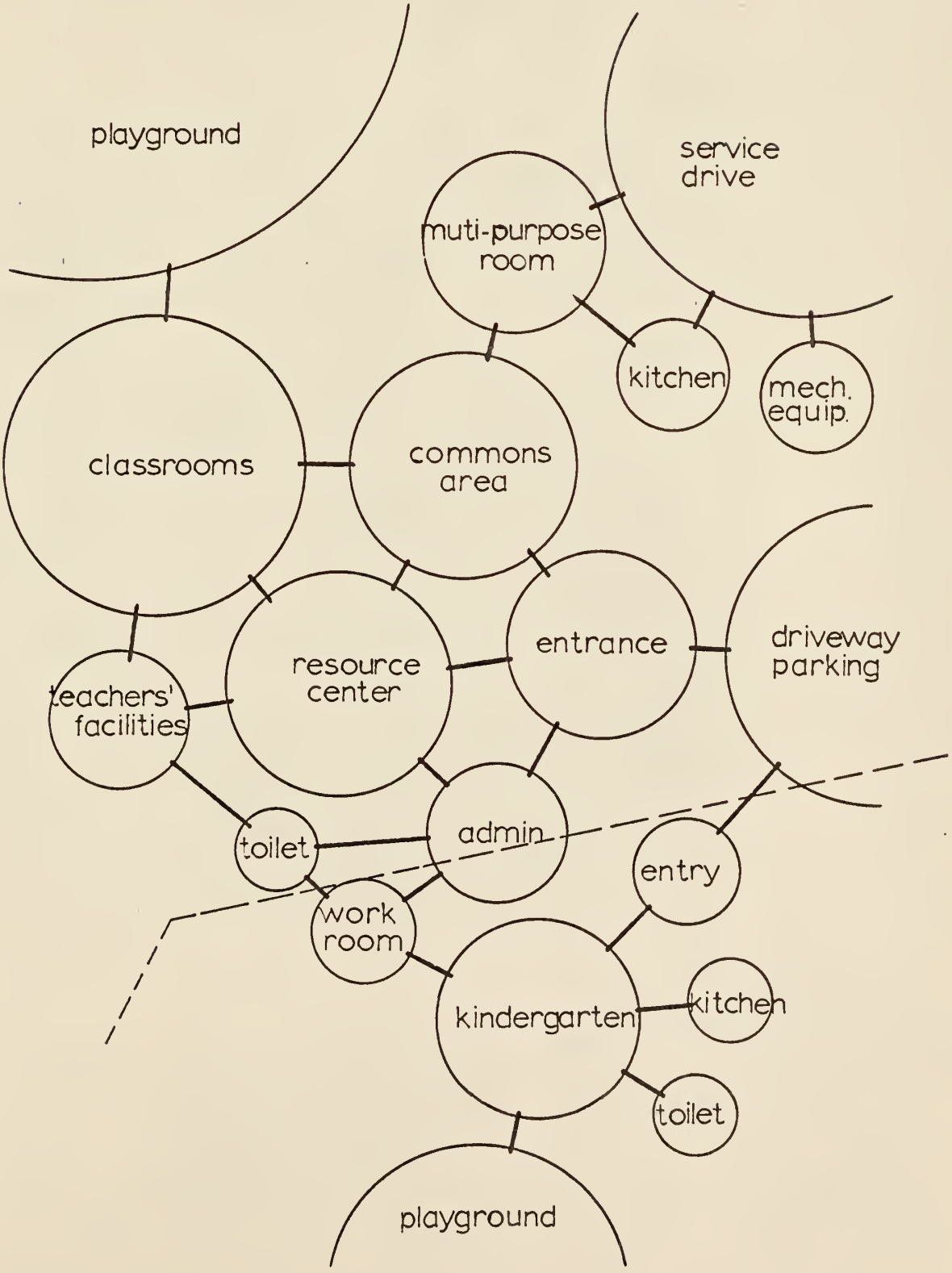
Reinforced concrete inverted hyperbolic paraboloid umbrellas will be used in the general instructional area as the roof system. The structure of the lecture hall will be of concrete folded plates. A waffle flat-slab roof providing large clear span areas will be used in the remaining part of the school. Exterior walls will have pre-cast concrete panels on both sides with 2" fiberglas insulation between.

III. THE JUNIOR-SENIOR HIGH SCHOOL

The Site

Since Manhattan is growing northward and westward including the northward expansion of Kansas State University, the new secondary school complex should, therefore, preferably be located at the northwest edge of the city. The site selected presently is farm north of the City-County Park.

FIGURE 13
FUNCTIONAL ANALYSIS OF
THE ELEMENTARY SCHOOL



The Program

A Junior High School and a Senior High School will be joined together in this school complex. Each will function as an ordinary secondary school in general academic areas, but will be sharing one auditorium, one gymnasium and will be under one administration. Students will be placed in various size groups from five to two hundred under a team teaching system. They will be using 20-minute units; each class will be allotted two, three, or four units as necessary. Students will spend a great deal of non-class time in individual study. Enrollment will be eight hundred for Senior High and nine hundred for Junior High.

Design Descriptions

Classrooms. The basic idea of grouping the classrooms about a common space is to provide an individual work-study area within every department and to emphasize the specialty of each department.

The resource center. A library will be centrally located in each of the schools. It will be composed of a reference area, a working area, and reading areas. A circulation counter will be located in the center for easy access and supervision. Ample space will be provided for individual studies.

Commons area. This area will be serving mainly as a circulation area between the two academic areas, the auditorium and the gymnasium. Student lounge and lunch areas will also be situated in this area.

The auditorium and audio-visual studio and material center. The audio-visual emphasis is reflected in the shape of the auditorium and in the spaces created when they are divided by operable walls. The three teaching areas in the auditorium--one for 300 students and two for 250 each--are wedge-shaped, providing ideal sight lines for audio-visual presentation. The auditorium is relatively shallow so that projected images can be read by students in the last row. Each of the two movable partitions will be in two parts, one dividing the stage, the other the seating area. Through all overhead tracking system, both sections are moved into garages at the ends of the hall to open up the auditorium. Movement of the partitions is accomplished by mechanical means. Rear projection is regarded as preferable for instructional purposes since lights can be left on for note-taking.

The administration. The administrative suite is located near the main entrance. This area consists of the principal's office, the vice principal's office, general school office, health office, and a general storage.

Music and drama education. Music and drama instruction will take place near the backstage of the auditorium. Provisions are made for both vocal and instrumental practices. Dressing rooms, a workshop, and a storage area are provided for drama education.

Physical education. The divisible gymnasium will serve the student body of both schools. Separate boys' and girls' locker rooms will be provided for the junior high and senior high school students. Outdoor playground and ball courts will essentially be in two groups, one for junior high and the other for senior high students.

The Academic Area of the Junior High School

Arts and Crafts. There will be painting and crafts studios with a common display area.

Home making. A home type of kitchen will be provided. There will be sewing machines and working counters also.

Industrial arts. Students will learn to work with electrical and mechanical machines. There will be one machine in each category of the typical mechanical workshop. Some individual work areas are also provided.

Science. Biology, chemistry and physics will be introduced to the students in general. There will be laboratories and recitation rooms in this department. Demonstrations and

lectures will be given to large groups in the auditorium.

Business education. There will be special classrooms where students learn to operate basic business machines, to conduct general office procedure, and to keep books. Provisions will be made for sufficient electrical outlets.

Teachers' complex. This area consists of the teachers' lounge, teachers' work room, guidance office, and toilets.

The Academic Area of the Senior High School

Science. There will be laboratories for biology, chemistry, and physics. A greenhouse will be attached to the biology laboratory. Working counters and a display area will also be provided in conjunction with the laboratories.

Business education. There will be a common classroom for shorthand and bookkeeping and separate rooms for typewriting and business machine operating.

Home economics. There will be a sewing area and a kitchen area for home making experiments, research and project areas for child care and development, exhibition and demonstration areas for housing, home furnishings and related arts.

Arts and crafts. Special provision shall be made for ventilating and lighting the painting and craft studios. A storage room and a kiln room will be provided in this area.

Language. Two language laboratories and a recitation room will be provided in this area. Individual study carrels for language studies will be provided in this area and in the library.

Technical workshops. Students will be working on metals, automobiles, electricity, wood printing, and photography in this area. Special provision will be made for safety.

Guidance and counseling. This area is located near the center of student activities and adjacent to the library. There will be three counseling rooms and a secretary-receptionist.

Construction, Material and the SCSD Project

In this school complex, the basic idea of SCSD (School Construction System Development Project)[1] will be employed. The SCSD is a practical development of a method of building better schools more rapidly and economically. Basically it is a means of applying the efficiency of modern industrial mass production to the construction of schools, but still avoiding standardized plans of monotonous repetition. It is also a way of providing for specific educational requirements

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[1] Educational Facilities Laboratory, "School Construction System Development Project" (New York, 1967).

by using manufactured parts. The specifications emphasize the need for compatibility of the various building components--that is the system approach.

The architect is not limited in plan layout and has a number of choices within the component ranges. Exterior walls are not a part of the system, these materials are selected by the individual architect.

One of the most important aspects of the performance specifications is that the structure, lighting, and mechanical subsystems are all contained in a 36-inch space between the roof deck and the ceiling. This is known as the "service sandwich". Here, in wiring lighting, TV conduits, air ducts, and plumbing are interlaced, rather than each being allowed a separate layer of space. Most of all, to meet the changing needs of the schools, the new specifications emphasize the possibility of changes. The steel frames are required to offer a variety of clear spans from 30 to 110 feet, on a basic five-foot module.

Within these spaces the interior partitions are to be demountable so far as possible. There are two types of operable walls: accordion partitions, and rigid folding-panel sliding partitions. These two types give architects maximum flexibility in providing for future changes in school needs and for unforeseeable developments in school programs. Air-conditioning outlets, with flexible ducts, may be moved to

almost any line on the five-foot grid, and independent controls may be provided for up to eight spaces in each module of 3,600 square feet. Lights of several varieties are interchangeable with ceiling panels.

In short, the SCSD system is providing an economical way to build changeable buildings for today's rapidly changing education. In the High School Complex the SCSD structures will be incorporated with reinforced concrete hyperpodic paraboloid umbrellas as the roof system. Exterior walls will be of pre-cast concrete panels on both sides with 2 inches fiberglas insulation between. The sides of the roof will be faced with molded sheet metal plates.

FIGURE 14
SCSD COMPONENTS

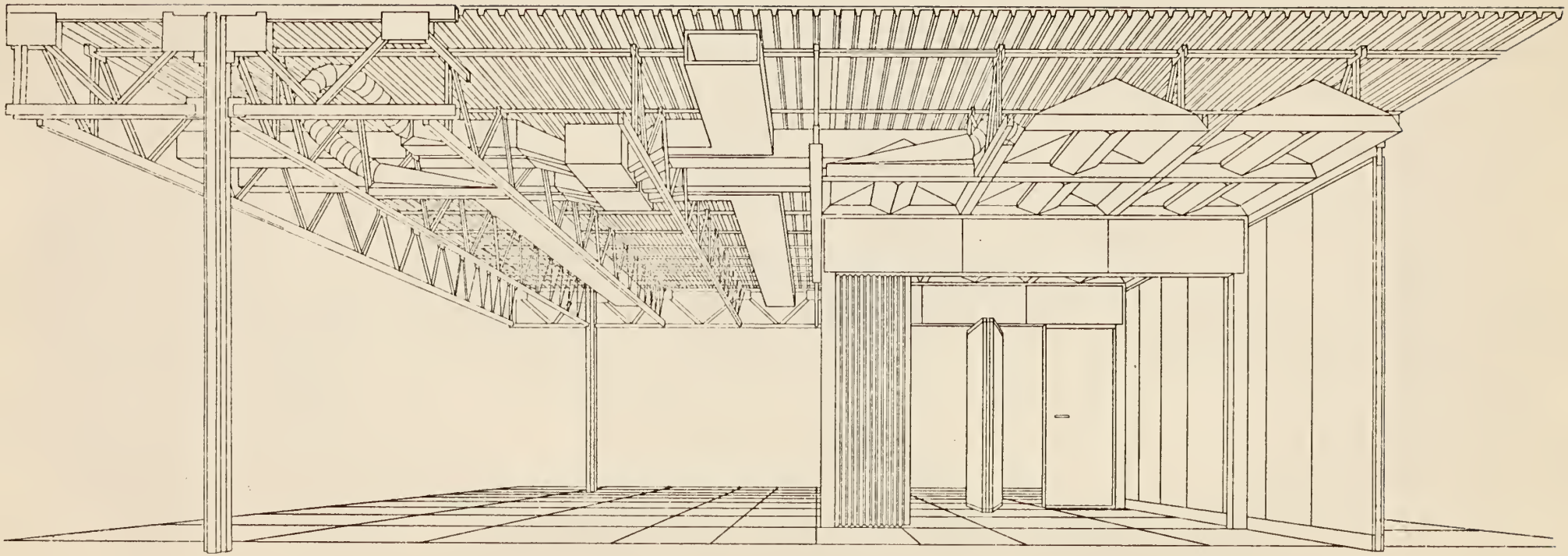
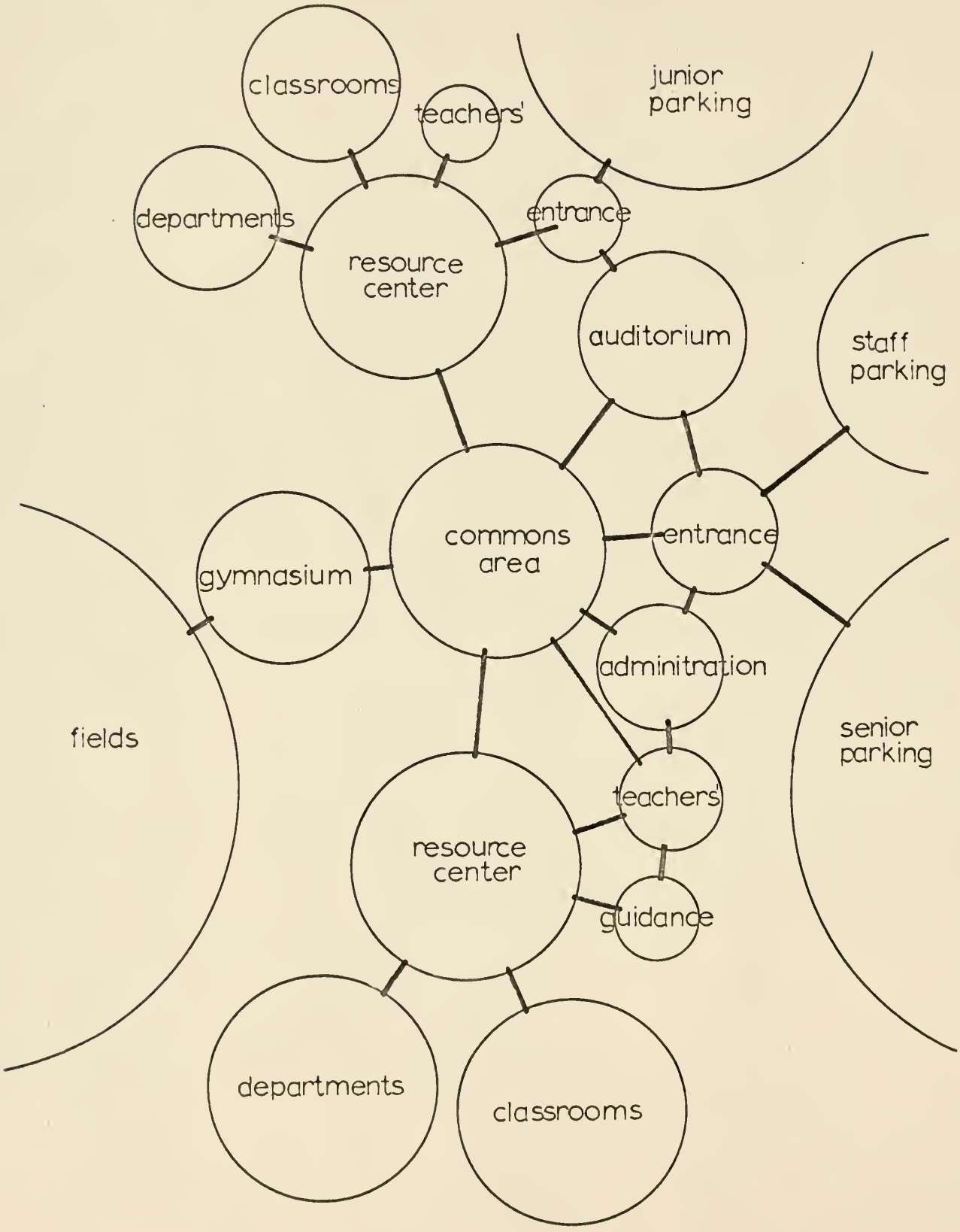


FIGURE 15
FUNCTIONAL ANALYSIS OF
THE SENIOR-JUNIOR HIGH SCHOOL



CHAPTER VII

THE ENVIRONMENTAL CONSIDERATIONS

I. CLIMATOLOGY

Temperature for Manhattan, Kansas

TABLE XII

TEMPERATURE FOR MANHATTAN, KANSAS

Month	Maximum	Normal	Minimum
January	39.6	29.2	18.5
February	44.3	32.4	21.1
March	56.5	44.0	31.4
April	67.9	55.2	42.5
May	76.6	64.8	52.6
June	86.7	74.7	62.6
July	93.0	80.2	67.6
August	91.5	78.5	65.8
September	83.6	70.5	57.8
October	71.2	58.1	45.2
November	56.0	44.0	31.8
December	42.9	32.2	22.0
YEAR	67.4	55.3	43.2

Wind for Manhattan, Kansas

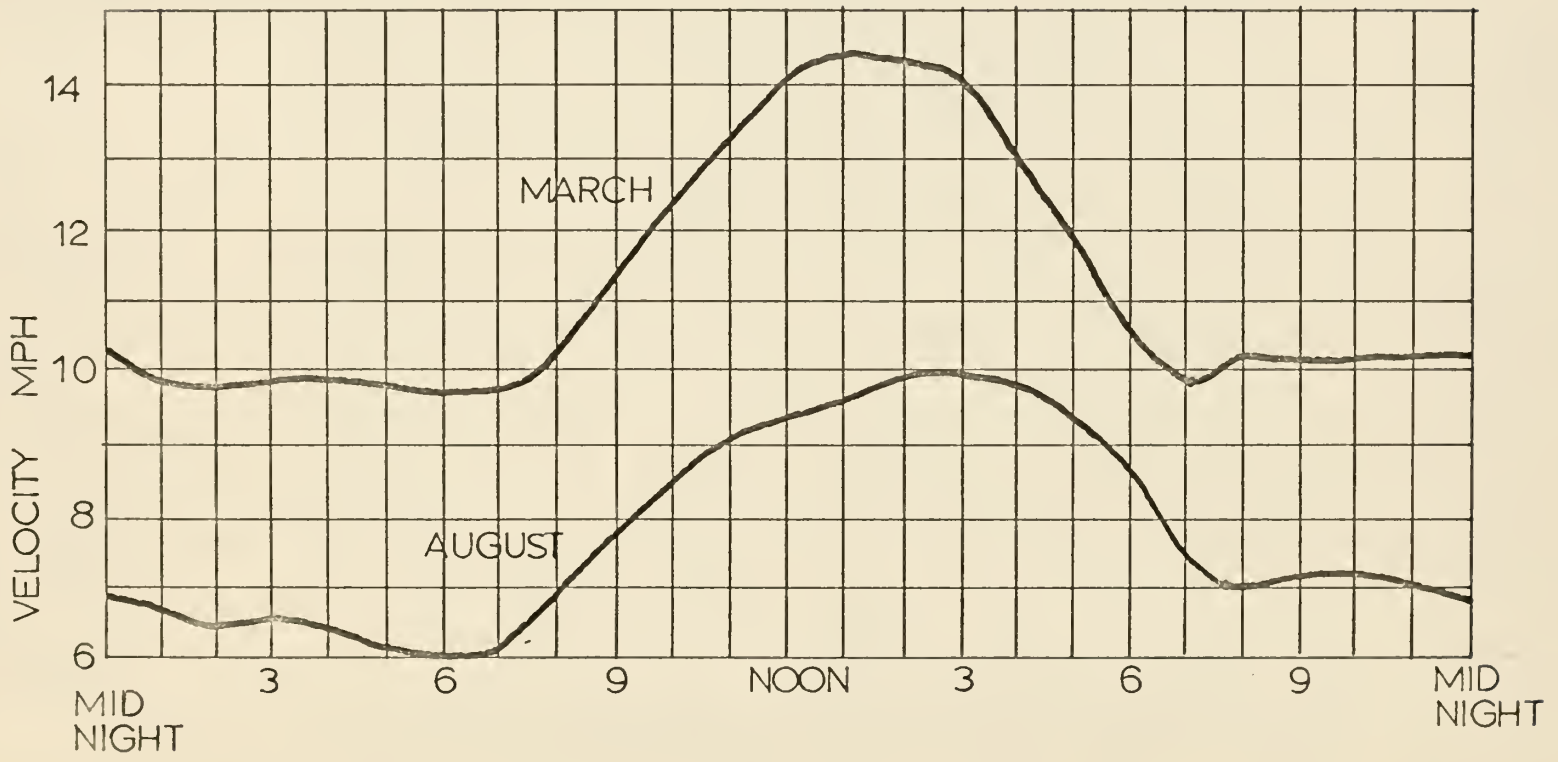
TABLE XIII

WIND DIRECTION AND VELOCITY IN MANHATTAN, KANSAS BY MONTH

Month	Prevailing direction	Average velocity
January	N.W.	9.1 mph
February	N.	9.6
March	N.	10.8
April	S.	10.8
May	S.	9.3
June	S.	9.0
July	S.	8.3
August	S.	8.3
September	S.	8.6
October	S.	8.6
November	S.	9.5
December	S.	8.8

FIGURE 16

AVERAGE HOURLY WIND VELOCITY
TOPEKA, KANSAS



Relative Humidity in Manhattan, Kansas

TABLE XIV

RELATIVE HUMIDITY IN MANHATTAN, KANSAS

Month	Hour			
	Midnight	6:00 a.m.	Noon	6:00 p.m.
January	75	77	63	67
February	77	80	62	64
March	74	79	56	56
April	73	79	52	53
May	80	85	55	55
June	81	86	57	57
July	80	86	55	55
August	77	86	53	54
September	73	82	46	49
October	75	82	49	56
November	74	78	52	59
December	76	79	61	67
MEAN 11 YEAR RECORD	76	82	55	58

Precipitation

TABLE XV

MONTHLY DISTRIBUTION OF HAIL STORMS 1929 TO 1945

Month	Number	Month	Number
January	1	July	117
February	3	August	89
March	19	September	36
April	106	October	8
May	236	November	1
June	285	December	2

FIGURE 17
KANSAS PERCIPITATION

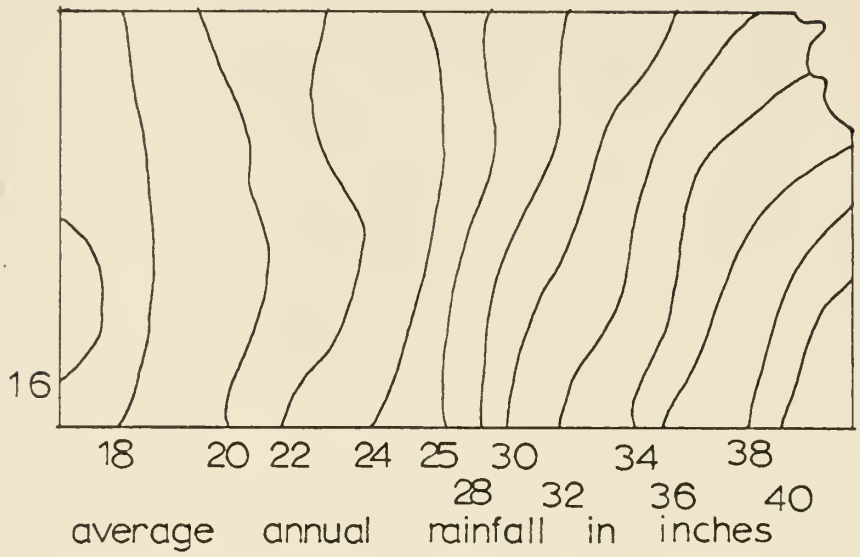


FIGURE 18
MEAN MONTHLY PERCIPITATION
1887 - 1945

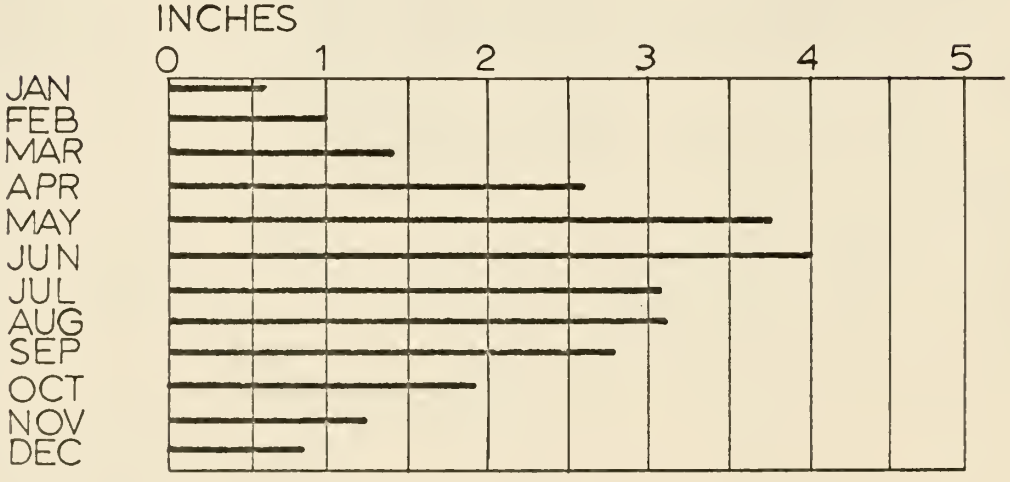


TABLE XVI

RILEY COUNTY PRECIPITATION

Normal precipitation (inch per month)			
January	0.71	July	3.73
February	1.22	August	4.24
March	1.62	September	3.93
April	2.66	October	2.25
May	4.43	November	1.77
June	4.61	December	0.86

Greatest recorded annual precipitation: 50.82 (1915).

Least recorded annual precipitation: 25.54 (1936).

Average number of days with .01 in. precipitation 80

.25 in. precipitation 35

1.00 in. precipitation 8

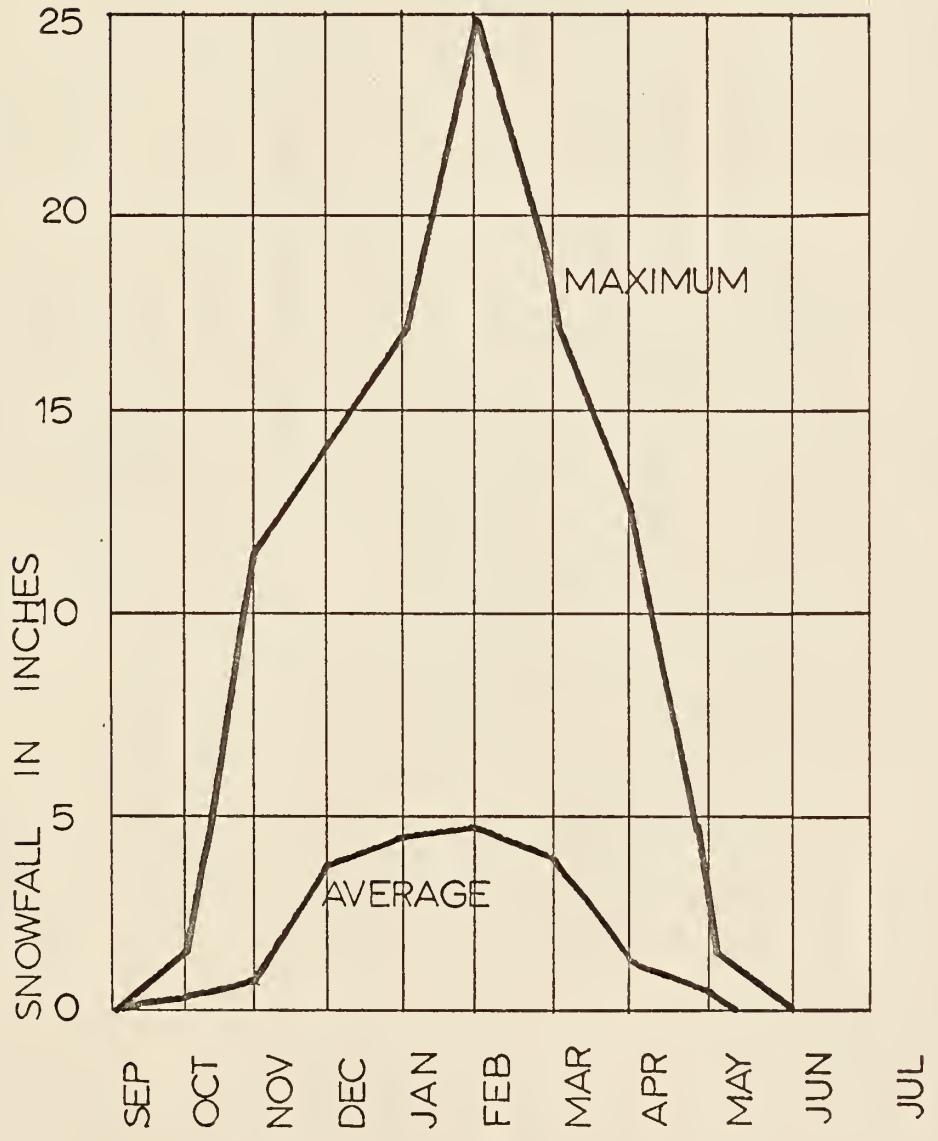
TABLE XVII

MANHATTAN PRECIPITATION

	Per cent probability of rainfall amounts per month											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
0.25 & under	25	15	12	1	0	1	3	3	0	1	18	12
over 0.25	75	85	88	99	100	99	97	97	100	99	82	88
0.50	57	70	80	98	100	98	96	94	99	94	72	64
0.75	36	61	68	93	100	96	93	91	96	85	65	45
1.00	27	48	58	90	99	94	91	84	92	78	57	39
1.50	14	25	41	74	93	92	88	80	83	65	40	16
2.00	7	14	28	57	83	82	81	69	72	51	24	11
3.00	0	2	10	33	65	72	67	49	57	17	10	1
4.00	0	2	6	23	47	56	52	41	42	12	6	0
5.00	0	1	2	10	35	40	33	31	20	7	6	0
6.00	0	0	1	6	23	31	24	23	10	3	2	0
8.00	0	0	0	2	8	8	7	11	2	2	0	0
10.00	0	0	0	0	1	3	2	7	0	1	0	0

Greatest precipitation in a 24 hr. period: 6.65 in.--August 25-26, 1944.

FIGURE 19
WINTER STORMS AND SNOWFALL
MANHATTAN KANSAS



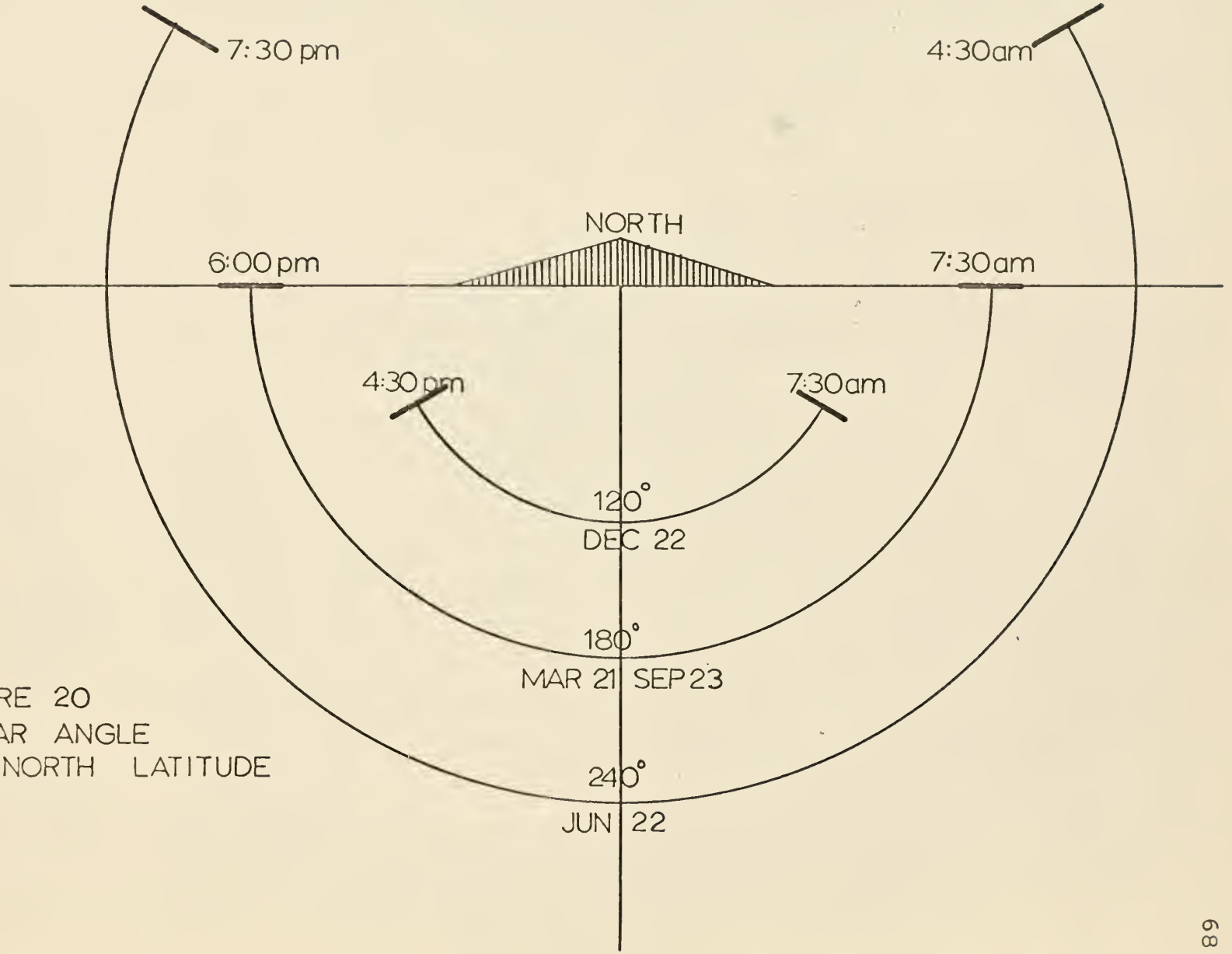


FIGURE 20
SOLAR ANGLE
40° NORTH LATITUDE

II. ACOUSTICS

Every space that man occupies is an acoustical environment. In the classroom speech is the essential type of sound to be planned for. Good acoustics are critical in all learning spaces, particularly in the large group rooms where many students are usually involved in the communication process. Generally the problems of acoustics are classified into two categories: the desirable sounds and the undesirable sounds.

The Desirable Sounds

Distribution. The ideal situation is one in which the sound must be so distributed that speech at one point of the room can be heard clearly and distinctly at any other point in the room. If the hall contains less than 50,000 cubic feet, distribution should be possible without amplification.

Optimum Reverberation Time. Sound created in an enclosed space tends to be reflected from surface to surface and thus to linger, sometimes for two seconds or more, until it eventually is absorbed, transmitted through walls and other surfaces, or has escaped through ducts and other openings. The length of the time between the creation of a sound and a drop to one-millionth of its original intensity is termed reverberation time. Reverberation is a crucial factor in auditorium design since it lends a desirable quality

called "intimacy" by musicians.

Masking background noise. Often it is desirable to maintain a certain level of background sound to avoid an oppressively silent space or to prevent the distraction caused by even relatively quiet sounds in a very quiet space. It is seldom possible or necessary to provide a partition capable of preventing transmission of all the sound from the source room. What is necessary is a reduction which brings the level of transmitted sound down below the normal background noise level in the quieter room. Twenty decibels below is normally enough.

Reinforcing. Hard, non-absorbtive surfaces such as plaster, concrete, glass, wood panels, etc., may be useful in reflecting sound and directing it to distant parts of a room where it will reinforce the sound coming directly from the source.

Diffusion. Diffusion promotes a uniform distribution of sound, it insures a relatively smooth growth and decay of sound, and it improves the liveness of the room. In other words, it tends to enhance the natural qualities of speech and music. A certain amount of diffusion is especially advantageous in rooms in which microphones are used, as it greatly reduces the hazards of improper microphone placement.

The Undesirable Sounds

Distortion. Selective, irregular absorption or reinforcement of certain frequence sounds are the reasons of distorted sounds. Resonance is another reason for distortion of sounds. Resonance occurs when an object or material in an enclosed space is excited at certain frequences of the sound.

High levels. 85 db and above are almost always objectionable if continuous and prolonged. Whenever the noise level is high enough to interfere with communication and normal activity, it is undesirable.

Echo. Any reflected sound which is loud enough and late enough to be heard as distinct from the source is normally objectionable. If the path distance of the reflected sound to the audience exceeds the direct path distance by 65 feet or more, the reflected sound will be heard as an echo. Blur occurs when the difference between the reflected sound path and the direct sound path is over 54 feet but does not exceed 65 feet.

Flutter. Flutter occurs between a pair of parallel walls in a room. A multiple echo is produced as the impulse is reflected back and forth between the pair of reflective walls.

Acoustical Design

The acoustical environment should be such that it best serves the function of the room. Achievement of this goal requires the enhancement of desired sounds of speech and music, and the control of undesired noise and vibration. As an integral part of the architecture itself, the acoustical environment is controlled by many building elements such as zoning, shapes and forms, constructions and details, finish materials, and furnishings.

The designer should be fully aware of the importance of optimum acoustical environment in school buildings. In these school buildings, the task of insulating the sound between rooms is relieved by zoning the different noise level areas within the building, from very noisy to relatively quiet areas. The proper diffusion has been accomplished by using the umbrella type roof structures in a large instructional area of the elementary school. Hard floor surfaces are not only sound reflective but also the origin of the most disturbing sounds in the school buildings. A soft floor covering, which is employed in the libraries, playrooms, and large instructional areas, will muffle or eliminate disruptive sounds of dropping pencils and books, clicking heels or foot steps, scraping furniture, etc. The psychological effects of carpeting in the schools also leads to establishing natural disciplinary controls over both the sound output

of the student and his general behavior.

Acoustical Design for the High School Auditorium

The high school auditorium usually serves a wide range of functions. It is used as an assembly room, large classroom, theater, cinema, concert hall, etc. The acoustical environment is more critical in a large auditorium with eight hundred seats. The acoustical considerations of the high school auditorium will be discussed in detail in the following section.

The auditorium is located adjacent to the main entrance, the commons area and away from the relatively noisy part of the school complex such as workshops and the gymnasium. The uses of lobbies and other access areas are employed as sound traps to isolate the noise from the parking lot and the main part of the building. Aircraft noises can be blocked through the use of a space frame. Machinery, such as movie projectors, air-conditioning units, are insulated from floor by means of vibration mounts, and are isolated by heavy masonry walls.

To achieve good qualities for speech and music, it is essential that the sound be evenly diffused throughout the room, without focusing, and that the reverberation not be excessive at any frequency. Flutter echoes are eliminated by avoiding the use of parallel walls. The side wall elements with dimensional characteristics similar to that

of the long wave lengths are positioned to provide diffusion of sound by diffraction. Diffusion of sound is increased by the objects within the room scattering and thus randomizing the directions of the sound waves. The irregular surfaces of the brick wainscot and the wood slat surfaces of the upper part break up the side wall surfaces and provide numerous sound images which eliminate the possibility of echoes from the side walls.

Early reflection of sound is provided by suspended ceilings arranged in a way that enhances even distribution and maximum reinforcement of the sound through the auditorium. Sidewalls are also arranged to reinforce sound in all parts of the seating area. A suitable splay near the rear wall can be utilized to prevent echoes from reaching the front seating area, and at the same time to reinforce the sound for the last few rows. The varying size of air spaces above the ceiling and behind the plywood backstage eliminate the possible resonance.

The optimum reverberation time vs. the frequence characteristic is one that will allow all frequency components of speech and music to grow and decay at such rates during the transient state, and to be maintained at such levels during their steady states. Reverberation time is governed by the size and shape of the space and by the absorptive qualities of materials used in wall, ceiling and floor

surfaces and furniture, and the audience. It is possible, therefore, to design a predetermined reverberation time for an auditorium with reasonable accuracy through the choice of size, shape and material.

More details will be showing the calculations for optimum reverberation time in the following pages.

Total Volume: 263,500 cubic feet

Total Area: 29,234 square feet

Total Floor Area: 11,350 square feet

Optimum Reverberation Time Selected (at 500 cycle): 1.60 seconds

Formula Used: $$\frac{.049}{-2.3 \log_{10}(1-\bar{\alpha})} = T_{60}$$

TABLE XVIII

REQUIRED ABSORPTION

	125	250	500	1,000
Optimum Reverberation Time (Sec.)	1.6 x 1.43 = 2.27	1.6 x 1.16 = 1.85	1.6	1.6
$-2.3 \log_{10}(1-\bar{\alpha})$	.194	.24	.275	.275
	.18	.22	.24	.24
Total Sq. Ft.-- Units of Absorption Required	5270	6430	7050	7050

TABLE XIX

THE AMOUNT OF ABSORPTION OBTAINED

Surface	Material	Area Sq. Ft.	125		250		500		1,000	
1 Rearwall	Wood strips at random spacing backed with 3" fiber-glas	909	.31	282	.65	590	1.0	909	1.0	909
2 Upper part of side-wall	Wood strips at random spacing backed with brick wall	2232	.02	44.5	.02	44.5	.03	67	.04	89
3 Wainscot	Pierced brick wall backed with brick wall	2483	.02	49.6	.02	49.6	.03	74.5	.04	95
4 Backstage	Plywood with light bracing	495	.30	147.5	.25	122.5	.15	72.5	.10	49.5
5 Doors	Solid wood	546	.10	54.6	.07	38.2	.05	27.5	.04	22
6 Floor	Carpet	2495	.15	375	.25	625	.35	825	.45	1125
7 Stage	Wood	3610	.15	542	.11	496	.10	361	.07	252
8 Ceiling	Plaster on metal lath	11340	.15	1700	.10	1134	.06	680	.05	566
9 Seats	Upholstered (2/3)	3430	.49	1680	.66	2260	.80	2750	.88	3020
10 People in	Upholstered (1/3)	1715	.60	1015	.74	1270	.88	1510	.96	1650
Total		29234		5670		6629		7276		7677

125 cycle

$\bar{\alpha} = \frac{5670}{29234} = .194$

$-2.3 \log_{10}(1-\bar{\alpha}) = .2105$

$T_{60} = \frac{0.049}{29234 \times .2105}$

$= 2.1$ (seconds)

250 cycle

$\bar{\alpha} = \frac{6629}{29234} = .226$

$-2.3 \log_{10}(1-\bar{\alpha}) = .2481$

$T_{60} = \frac{.049}{29234 \times .2481}$

$= 1.78$ (seconds)

500 cycle

$\bar{\alpha} = \frac{7276}{29234} = .248$

$-2.3 \log_{10}(1-\bar{\alpha}) = .2741$

$T_{60} = \frac{.049}{29234 \times .2741}$

$= 1.60$ (seconds)

1,000 cycle

$\bar{\alpha} = \frac{7677}{29234} = .261$

$-2.3 \log_{10}(1-\bar{\alpha}) .3008$

$T_{60} = \frac{.049}{29234 \times .3008}$

$= 1.47$ (seconds)

The differences between either the required square-foot-units of absorption and those obtained or the required reverberation time and those achieved are within a ten per cent range of that required. The design is, thus quite satisfactory.

III. HEATING, VENTILATION AND AIR-CONDITIONING

The physiological behavior of the human body demands an equality between the rate of internal chemical heat production and the rate of external physical heat loss. The human body maintains a remarkable system of temperature control to regulate this loss, which occurs by radiation, convection and evaporation. The relative proportion of each depends upon the total heat production produced by activity, the amount of clothing, the temperature of surrounding walls, and the properties of the ambient air.

Temperature

Since maintenance of life itself is impossible without maintenance of body temperature, artificial heating within enclosures was the earliest attempt at modifying any of these properties. The effort to control temperature within predetermined optimum limits, requires a regulated amount of heating or cooling is of comparatively recent date. Proper control of the temperature of the air surrounding the body removes the physiological stress of accommodation, and thereby permits greater comfort, and improved physical well-being and health.

Humidity

A large proportion of body heat is lost by evaporation from the skin. Since evaporation is promoted by a low

relative humidity of the air and retarded by high humidity, humidity control has an important effect on comfort.

Air Motion

Movement of air over the body increases the rate of heat and moisture dissipation, thereby modifying the feeling of warmth and coldness. It also has other pleasing or displeasing effects, depending on the amount of the motion.

Air Purity

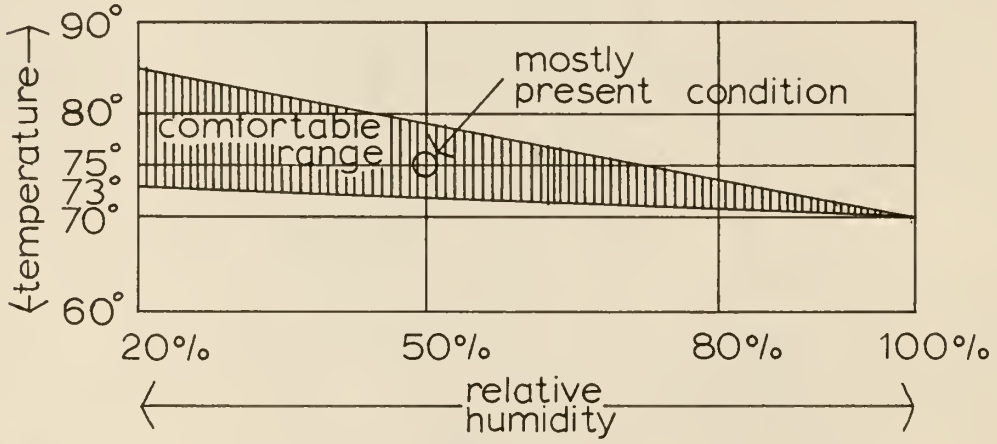
The physical and chemical composition of air embraces a number of diverse elements. The reduction of oxygen content and the increase of carbon dioxide as a result of physiological combustion are rarely important factors because of the very small amount of ventilation needed to nullify their effect. The dilution of body odors requires considerable use of ventilation or other means of odor removal. Removal of solid particles from air introduced into the space is important, not only from the health standpoint, but also from the inconvenience and maintenance expense of dirty surroundings and furnishings. Smoke, whether generated within the room or outside, requires removal because of its disturbing allergical effects.

Activity

The rate of bodily activity will of course influence the desirable room temperature.

To establish standards of temperature, humidity, motion and purity, it is essential to determine the optimum values of these properties in their effect upon human comfort. Since temperature, humidity and air motion all influence the rate and mechanism of body heat loss, they can be considered interrelated physiologically. It follows that a given combination of temperature, humidity and air motion will produce the same sensation of warmth or coolness as some other temperature with a corresponding humidity and air motion.

FIGURE 21
THE COMFORTABLE RANGE



Heating

In considering a comfort heating system bear in mind that heating is not done for the purpose of supplying heat to the human body. Rather, it is to prevent a greater loss of heat from the body than about 300 BTU per hour, the normal rate.

Cooling

The heat contribution of lighting (at 3.4 BTU per watt hour) and the students in the class room (about 300 BTU to 800 BTU per person hour) is always a problem, particularly in large-group rooms where there are many lights and people. Therefore, the prime function of the heating/cooling system during class hours will be to remove heat from the room and to control temperature in the comfortable range. Because of the constantly changing of lighting levels and varying class sizes, each space should have its own set of temperature control.

Ventilation

The amount of fresh air needed depends on the activities going on in the room, and the efficiency of the air cleaning system. The minimum amount of fresh air per person should be 10 to 15 cubic feet per minute. The chances are the cooling capacity should exceed these. Where smoking is permitted, a carbon filter or liquid absorption system may be required to control odors and remove dust particles.

Fresh air must not only be supplied, but proper air movement is essential for a good climate. Circulation of air over the surface of the body must be sufficient to carry away the layer of moist, warm air at the surface of the skin, and yet it cannot be provided in a way that produces noticeable drafts.

Rear projection and other equipment areas should be separately ventilated. Mechanical exhaust ventilation will be used in toilets, locker rooms, and similar areas for the removal of concentrated odors and fumes.

Humidity Control

Humidity should be kept within a general range of 30 per cent to 55 per cent to insure student comfort. Dehumidification may have to be provided to keep body evaporation from raising the relative humidity in the room.

In all three designs, the entire building will be air-conditioned. A high velocity dual duct system will be employed with individually controlled mixing boxes supplying tempered air to each room. Each building will be divided into zones, tempered air will be supplied to each zone from a multi-zone unit located in the mechanical equipment room.

IV. LIGHTING

Glare free are the key words in general classroom lighting design. Brightness alone cannot insure that a student will see if the material is distorted by reflection or glare. Students will engage in numerous and varied visual tasks including reading, writing, drawing, painting, modeling, working with tools and machines, manipulating scientific apparatus, watching demonstrations, and many others. Reading will be done from books and other printed matter at

desks and tables, as well as from charts, chalkboards, and bulletin boards. Maps, globes, graphs, models, charts and audio-visual devices will be used. The consensus of studies of lighting indicates that a room with an illumination of 35-70 foot candles will provide adequate brightness for general classroom use. Drafting rooms and sewing rooms need higher intensities ranging from 100 to 200 foot candles and higher. It is necessary to keep brightness at a constant level throughout the entire classroom including walls, fixtures, trim, floor, furniture, whatever is in sight.

Three illumination levels in the media-oriented spaces can be obtained by using three-tube fluorescent fixtures and wiring the fixtures to light one, two, or three tubes at a time.

There will be a combination of fluorescent luminous ceiling and semi-direct or direct incandescent lights in general instruction and commons area. In the areas where the hyperbolic paraboloid umbrellas are employed as the roof system, the umbrellas will be illuminated providing indirect lighting for these areas.

CHAPTER VIII

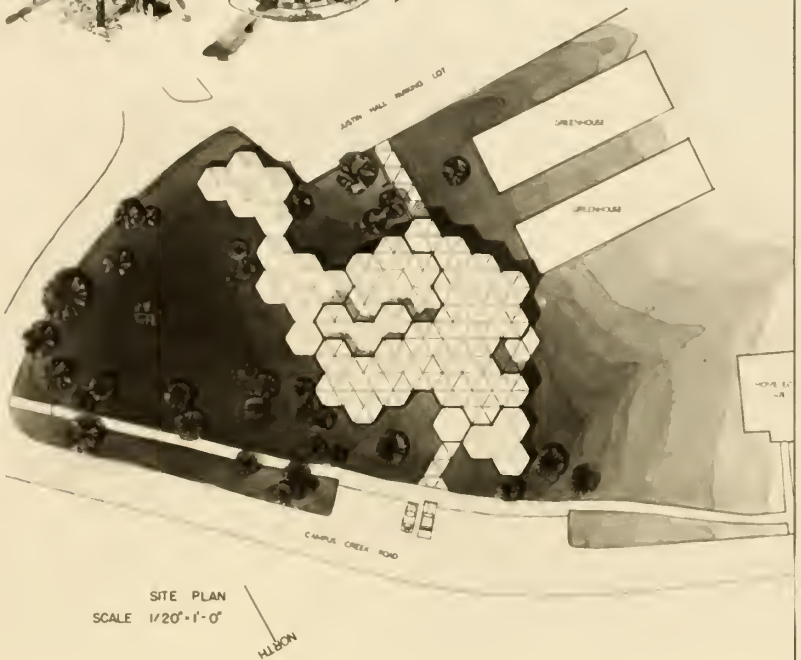
PRESENTATIONS

THE DESIGN OF CONTEMPORARY SHOOLS IN U.S.A.

BY IGNATIUS CHI-LO WANG
COLLEGE OF ARCHITECTURE AND DESIGN
KANSAS STATE UNIVERSITY
SPRING 1968

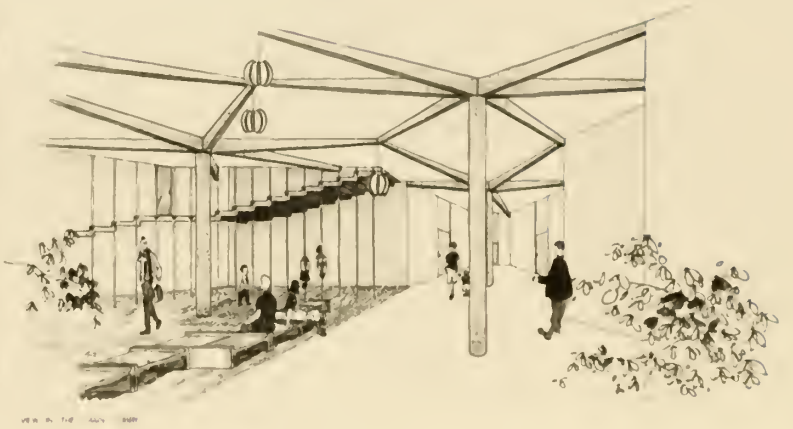
MAJOR PROFESSOR : THEODORE A. CHADWICK

THE CHILD DEVELOPMENT LABORATORY



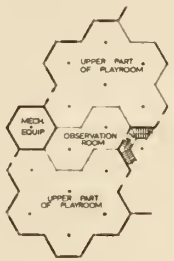
SITE PLAN
SCALE 1/20"=1'-0"

FIRST FLOOR PLAN
SCALE 1/16"=1'-0"



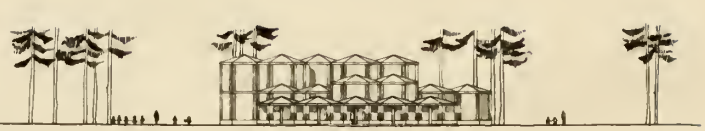
ELEVATION A
SCALE 1/16" = 1'-0"

ELEVATION B
SCALE 1/16" = 1'-0"



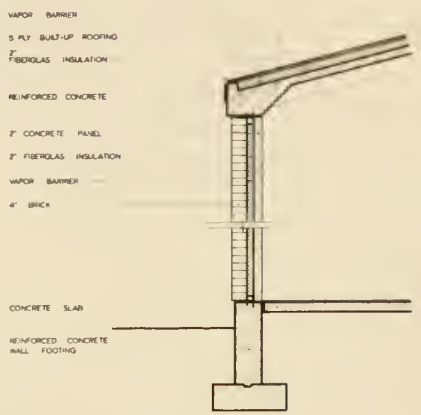
MEZZANINE PLAN
SCALE 1/16" = 1'-0"

SECOND FLOOR PLAN
SCALE 1/16" = 1'-0"



ELEVATION C
SCALE 1/16" = 1'-0"

SECTION A A
SCALE 1/16" = 1'-0"



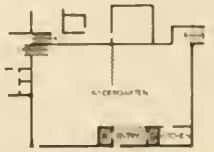
TYPICAL SECTION THROUGH EXTERIOR WALL
SCALE 3/32" = 1'

EAST ELEVATION
SCALE 1/20"•1'-0"

THE ELEMENTARY SCHOOL

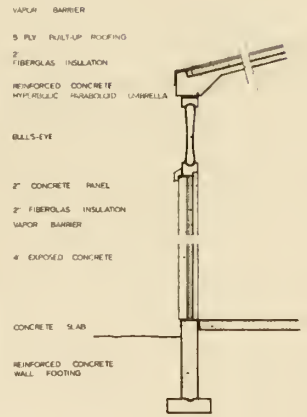
SITE PLAN
SCALE 1/50"•1'-0"

PLAN
SCALE 1/20"•1'-0"

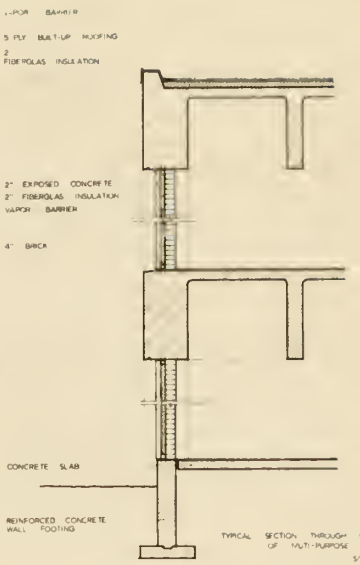


VIEW FROM ENTRANCE TO COMMONS AREA

VIEW FROM THE GENERAL INSTRUCTIONS AREA TO RESOURCE CENTER



TYPICAL SECTION THROUGH EXTERIOR WALL OF GENERAL INSTRUCTIONS AREA
SCALE 1/16" = 1'



TYPICAL SECTION THROUGH EXTERIOR WALL OF MULTI-PURPOSE ROOM
SCALE 1/16" = 1'

SOUTH ELEVATION
SCALE 1/20" = 1'-0"

WEST ELEVATION
SCALE 1/20" = 1'-0"

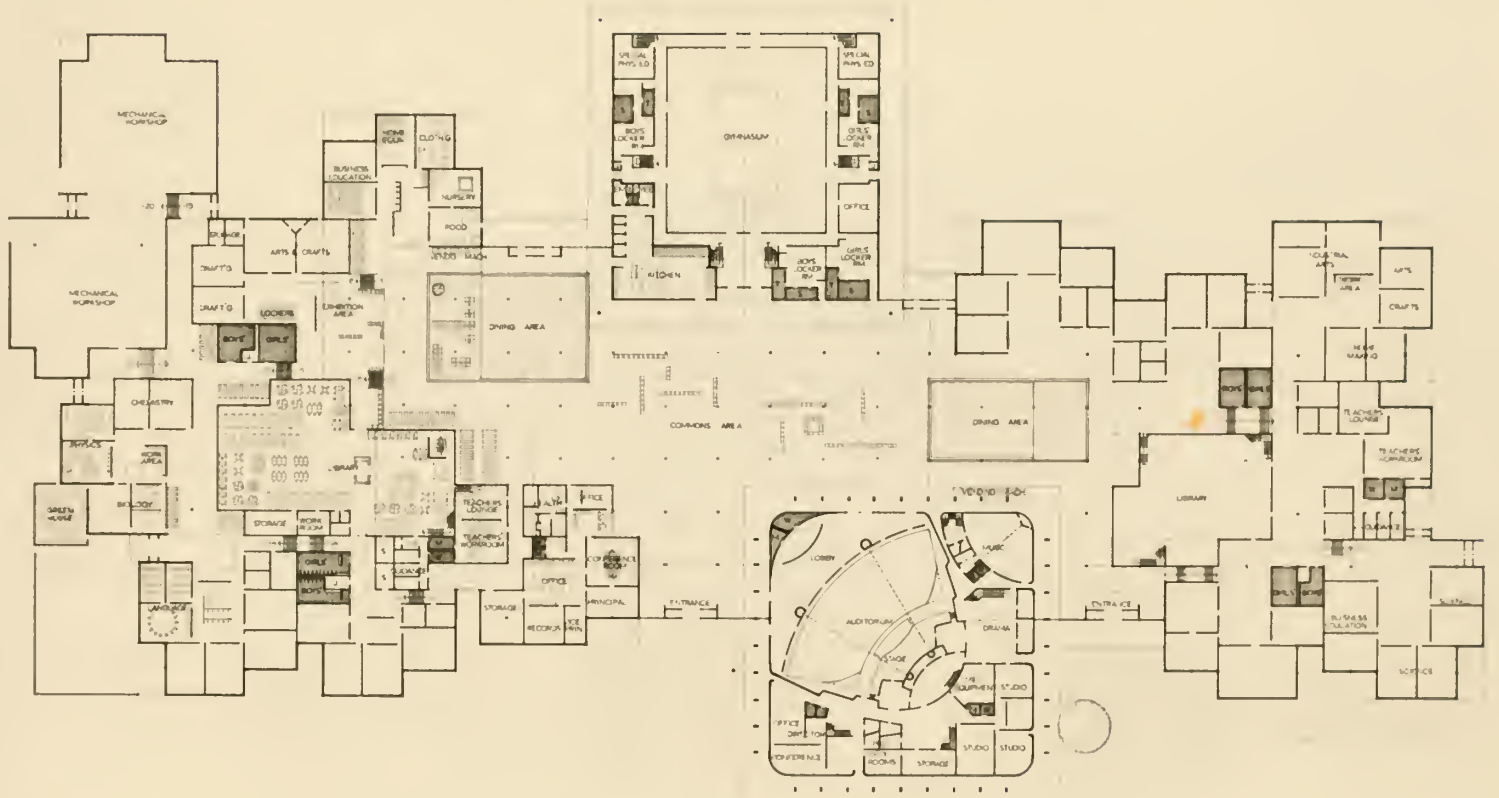
NORTH ELEVATION
SCALE 1/20" = 1'-0"

SECTION A A
SCALE 1/20" = 1'-0"

SECTION B B
SCALE 1/20" = 1'-0"

THE JUNIOR - SENIOR HIGH SCHOOL


NORTH
SITE PLAN
SCALE 1/100" = 1'-0"
STUDENT PARKING
FACULTY VISITORS
AUDITORIUM
GYMNASIUM
STUDENT PARKING

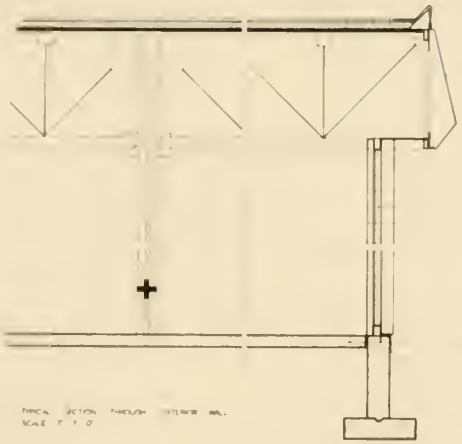


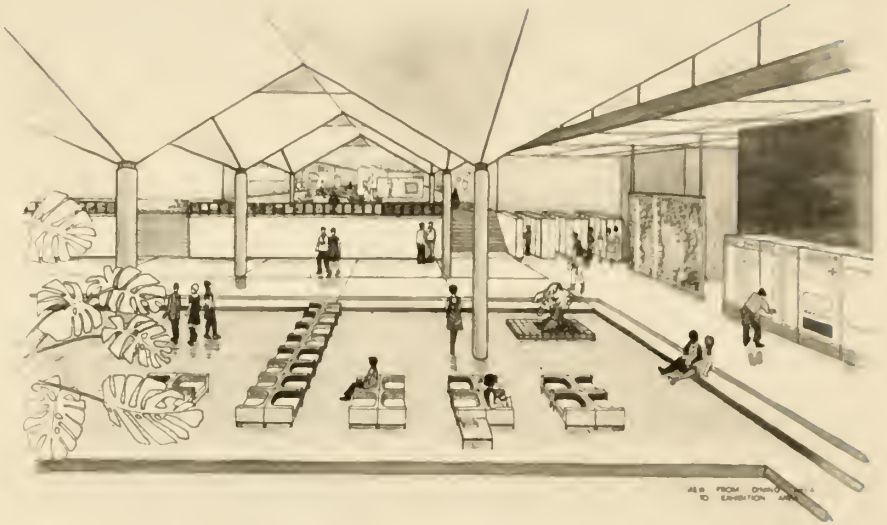
PLAN
SCALE 1/30" = 1'-0"

SOUTH ELEVATION
SCALE : 1/30" = 1'-0"

EAST ELEVATION
SCALE : 1/30" = 1'-0"

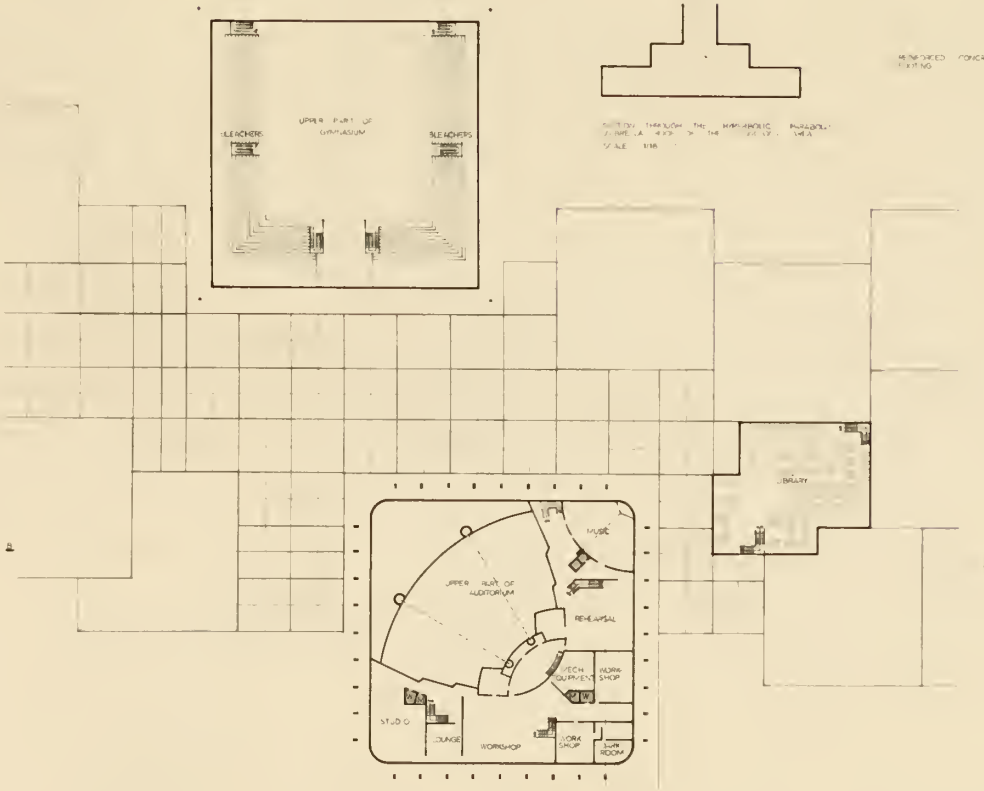
NORTH ELEVATION
SCALE 1/30" = 1'-0"



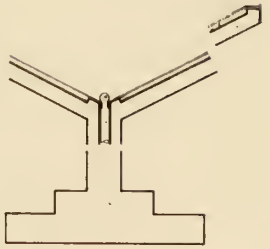


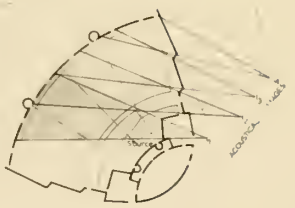
SECTION A A
SCALE 1/30" = 1'-0"

SECTION B B
SCALE 1/30" = 1'-0"



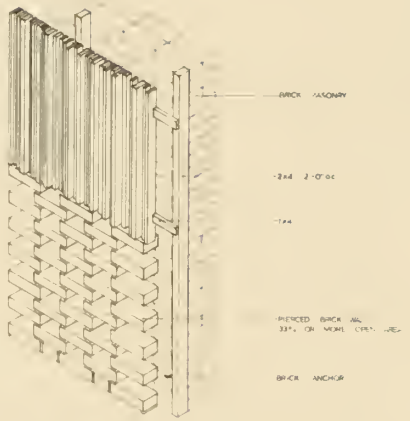
SECOND FLOOR PLAN
SCALE 1/30" = 1'-0"





AUDITORIUM SHAPING
POSITIONING OF SOUND REINFORCEMENT PLANES

SECTION



TYPICAL AUDITORIUM WALL
PROVIDES THE NECESSARY INSULATION BY CONSTRUCTION TO ELIMINATE NOISE AND LOSS

CHAPTER IX

CONCLUSION

Upon reaching the conclusion of this design project, the author realized that good architecture is an honest, simple statement concerning the function, the materials used, the structure, the site, and of the aesthetics involved in the project. There is no absolute solution to the problems involved, nor is there any final solution concerning the housing of education for a community. The school building is but a servant of the everchanging culture. Only the teachers and the students will be the final judges of the appropriateness of the design.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to Professor Theodore A. Chadwick, Dr. Ivalee H. McCord, Dr. O. Kenneth O'Fallon, and Professor Charles E. Parks, for their guidance and assistance in preparing the preliminary and final presentation of this project.

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THE DESIGN OF CONTEMPORARY SCHOOLS IN THE UNITED STATES OF AMERICA

by

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The primary intention of this design project is to determine the proper procedure in designing schools for a given community as a model study of its kind. In this design project, all three schools for Manhattan, Kansas--the Child Development Laboratory at Kansas State University; the Elementary School; the Secondary School--were designed with a definite educational philosophy in mind, namely: the concept of team teaching combined with those of intensified individual instruction, increased use of audio-visual aids, decentralized resource facilities, and efficient environment controls.

The Child Development Laboratory is affiliated with the Department of Family and Child Development at Kansas State University. The site selected for this laboratory is located on the campus of the university between Campus Creek Road and the Justin Hall parking lot. There will essentially be two groups of children at age three to four. The activities will mainly be indoor and outdoor playing, story telling, and creative activities. The college students in the Department will be engaged in helping the full time teacher in the playroom and the playground, observing childrens' behavior, research, and group discussing.

The school district of Manhattan owns a piece of land for a proposed elementary school in the newly developed residential area near Warner Park. The elementary school will

be serving 450 students from kindergarten through grade six. The kindergarten will be a separate, self-contained unit. Students of grade one through six will be integrated in a teaching-learning complex where numerous activities such as individual study, small group, medium group and large group instruction will be held, based on a non-grade system.

The site selected for the new Junior-Senior High School is located at the northwest edge of Manhattan city north of the City-County Park. Each of the Junior High School and Senior High School will function as ordinary secondary school in general academic areas, but will be sharing one auditorium, one gymnasium and will be under one administration. Students will be placed in various size groups from five to two hundred under a team teaching system. They will be using 20-minute units; each class will be allotted two, three or four units as necessary. Enrollment will be eight hundred for senior high and nine hundred for the junior high.

The environment factors such as acoustics, heating, lighting, ventilation and air-conditioning, were all taken into account to ensure comfort, health, and safety of the occupants.